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# ENVIRONMENTAL ASSESSMENT BOARD



## ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARINGS

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VOLUME: 144

DATE: Monday, May 11, 1992

BEFORE:

HON. MR. JUSTICE E. SAUNDERS Chairman

DR. G. CONNELL Member

MS. G. PATTERSON Member

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ENVIRONMENTAL ASSESSMENT BOARD  
ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARING

IN THE MATTER OF the Environmental Assessment Act,  
R.S.O. 1980, c. 140, as amended, and Regulations  
thereunder;

AND IN THE MATTER OF an undertaking by Ontario Hydro  
consisting of a program in respect of activities  
associated with meeting future electricity  
requirements in Ontario.

Held on the 5th Floor, 2200  
Yonge Street, Toronto, Ontario,  
Monday, the 11th day of May,  
1992, commencing at 10:00 a.m.

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VOLUME 144  
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B E F O R E :

THE HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

S T A F F :

MR. M. HARPUR	Board Counsel
MR. R. NUNN	Counsel/Manager, Information Systems
MS. C. MARTIN	Administrative Coordinator
MS. G. MORRISON	Executive Coordinator





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L. BULLOCK	)	CANADIAN NUCLEAR ASSOCIATION
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<u>KURT JOHANSEN,</u>	
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1       ---Upon commencing at 10:04 a.m.

2               THE REGISTRAR: Please come to order.

3       This hearing is now in session. Be seated, please.

4               THE CHAIRMAN: Mr. Campbell.

5               MR. B. CAMPBELL: Mr. Chairman, I would  
6       just take a moment given the nature of my submissions,  
7       I would ask that the Board try and -- we all really try  
8       and keep close track of the timing as we move through  
9       these three days.

10              We have a problem in that Dr. Whillans is  
11       Hydro's representative to an international conference  
12       that he departs for on Wednesday at seven, his plane  
13       takes off. And my reading of the schedule is that we  
14       have Mr. Wright approximately an hour, Mrs. Mackesy  
15       approximately a further hour --

16              MRS. MACKESY: Excuse me. I think I  
17       might be two or three hours.

18              MR. B. CAMPBELL: All right. Two to  
19       three hours. This is how good the information is that  
20       I get.

21              Northumberland, perhaps a day. Mr.  
22       Fedorsen for Mr. Bourgeois, we have obtained  
23       conflicting estimates, everything from relatively short  
24       to a day, and that may not be the contradiction that I  
25       see. That just may be the sense of what relatively

1 short is.

2 We have the government and possibly Mrs.  
3 Young.

4 If necessary, as we get through today, I  
5 would ask that the Board consider perhaps extending its  
6 hours slightly, perhaps taking a shorter lunch break,  
7 and trying to get through so this panel can be  
8 finished. But this is an important conference. It's  
9 topical. And it is one that Dr. Whillans -- I feel  
10 particularly vulnerable about because I assured Dr.  
11 Whillans that I could not see how this panel could  
12 possibly last so long that this would be a threat for  
13 him getting on that plane.

14 And I am sure that if there is a problem,  
15 he will remind me of that rather forcibly and I would  
16 like to spare myself that grief as well.

17 I also intend to try and contact Mr.  
18 Fedorsen today. We have some concerns, given the  
19 material that has been filed on behalf of Mr.  
20 Bourgeois, and I will have a discussion with him along  
21 the lines that we are concerned that this forum not be  
22 used to try and deal with matters of liability, if you  
23 will, between claims that Mr. Bourgeois makes and  
24 Ontario Hydro. And I will try and speak to him on that  
25 matter today.

1                   But I thought I should just alert the  
2     Board to our concerns in this matter and anything that  
3     can be done to ensure that we are able to finish by  
4     Wednesday, we would certainly appreciate.

5                   THE CHAIRMAN: I am sure we can  
6     accommodate that with some flexibility of time.

7                   I should let you know now that we are  
8     going to have to -- I have an obligation to perform on  
9     Wednesday in the middle of the day so that we will have  
10    to stop at eleven-thirty on the Wednesday morning and  
11    reconvene at two o'clock, so I think we should have  
12    that in mind.

13                  MR. B. CAMPBELL: Thank you, Mr.  
14    Chairman.

15                  THE CHAIRMAN: Just as a housekeeping  
16    matter, I want to record because it hasn't been  
17    formally recorded, although it has been filed, Exhibit  
18    452G, as in George. The author is Ontario Hydro. It's  
19    a document providing revised figures and data  
20    corresponding to Exhibit 4 of the environmental  
21    analysis report for the update managed surplus upper  
22    load forecast cases and the median load forecast no  
23    approvals case.

1       ---EXHIBIT NO. 452G: Document providing revised  
2                               figures and data corresponding to Exhibit  
3                               4 of the environmental analysis report  
4                               for the update managed surplus upper load  
5                               forecast cases and the median load  
6                               forecast no approvals case.

7                               THE CHAIRMAN: I understand that Mrs.  
8                               Mackesy has yielded to Mr. Wright to conduct his  
9                               cross-examination which is about commence.

10                              Ms. Harvie.

11                              MS. HARVIE: Yes, Mr. Chairman, there are  
12                              two matters that I will ask the witnesses to address  
13                              very briefly regarding issues that arose last week  
14                              during the cross-examination, and they were subject  
15                              check and they are now back to report on that check.

16                              THE CHAIRMAN: Thank you.

17                              DAVID WHILLANS,  
18                              KURT JOHANSEN,  
19                              FRANK CALVIN KING,  
20                              WILLIAM JOHN PENN,  
21                              IAN NICHOL DALY; Resumed.

22                              MR. PENN: Mr. Chairman, I undertook to  
23                              check some figures that appear in Exhibit 643 which Mr.  
24                              Greenspoon on behalf of his client introduced and  
25                              appears in Volume 138 of the transaction, pages 24280  
26                              to 24282. And that table gave, using some information  
27                              that Ontario Hydro presented, a dollar figure in  
28                              dollars per pound of concentrate of uranium for the  
29                              years 1970 to 1990.



1 I looked at this check and the first  
2 thing we wish to note is concentrate is expressed in  
3 dollars per pound of U(3)O(8) and the conversion from  
4 megagrams of uranium to pounds of U(3)O(8) should be  
5 2.60 as opposed to 2.2 that was in Exhibit 643.

6 And the second point I would like to make  
7 is that there was discussion on the relevancy of the  
8 spot price of uranium in U(3)O(8) again expressed in  
9 U.S. dollars per pound of U(3)O(8). And I wish to  
10 point out that from 1983 onwards, Ontario Hydro  
11 provided money to various mining companies to secure  
12 uranium from Elliot Lake and that necessarily premiums  
13 have to be paid above spot prices on the market, which  
14 are small quantities of uranium offered on a daily  
15 basis.

16 Thank you, Mr. Chairman.

17 THE CHAIRMAN: Thank you, Mr. Penn.

18 MR. DALY: Mr. Chairman, I undertook to  
19 follow up on a question from Mrs. Mackesy. This was  
20 with reference to volume 143 and the question was asked  
21 at page 25256. And this was a question as to what was  
22 the 1991 total net generation from the Bruce "A" and  
23 Bruce "B" generating stations? In '91, the total net  
24 electrical output from Bruce "A" and Bruce "B" was  
25 42,816 gigawatthours, which should be compared with a

1 primary demand of 137,200 gigawatthours, indicating  
2 that the Bruce units provided about 31 per cent of the  
3 total primary demand in 1991.

4 THE CHAIRMAN: Is that it?

5 MR. DALY: Yes.

6 THE CHAIRMAN: Mr. Wright.

7 MR. WRIGHT: Honourable panel. Ontario  
8 Hydro.

9 CROSS-EXAMINATION BY MR. WRIGHT:

10 Q. Do you use a failsafe process?

11 MR. KING: A. Could I ask what process  
12 you are talking about? We use some failsafe processes.  
13 I am not sure which one you are talking about.

14 Q. Sage, Sage Analysis, S-A-G-E.

15 A. I am somewhat familiar with Sage  
16 analysis but not in detail and I am not aware, not  
17 personally aware where or if it is used in Ontario  
18 Hydro. Sage being a company which is involved in  
19 consulting work associated with a specific type of  
20 problem analysis, am I correct, yes.

21 Q. But you use other systems, other  
22 failsafe systems?

23 A. Perhaps it's the term "failsafe"  
24 which I am failing to grasp your meaning of. We talk  
25 about failsafe in talking about mechanical electrical

1 systems, where a system, a mechanical electrical  
2 system, fails in a certain way such that it is in a  
3 safe mode, but I have a feeling you are not talking  
4 about that sort of definition.

5 Q. As they explained to me years ago,  
6 basically it was when you have done everything you can  
7 on a positive basis to make sure nothing goes wrong,  
8 you then start working on the negative side.

9 A. We do risk analysis where you start  
10 with the negative outcome that you don't want as your  
11 top event and you develop through inductive and  
12 deductive logic development models for how that  
13 undesirable top event will occur. So it is certainly  
14 working in the failure regime rather than the success  
15 regime.

16 Q. Well, Sage Analysis enjoy working  
17 with you. They said the same kinds of things as Dr.  
18 Hare said that there is no questioning the dedication  
19 and the focus in that kind of area.

20 What do you think are the practical  
21 active components of safe systems?

22 [10:15 a.m.]

23 A. The practical and what?

24 Q. Active components in a genetic  
25 phrase, in a genetic sense?

1 A. Genetic?

2 Q. As in genetic food, genetic medicine,  
3 in other words.

4 A. Generic.

5 Q. Generic, sorry. Thank you.

6 A. If you are referring to equipment,  
7 mechanical electrical equipment or are we talking about  
8 processes again?

9 Q. Equipment would be one, process would  
10 be another.

11 I mean, what makes up safe systems?

12 A. Well, if you are trying to design a  
13 very reliable system to perform a certain function,  
14 there are certain design principles one follows, I  
15 covered some of these in my direct evidence.

16 Q. Process is the answer to that, I  
17 mean, equipment processes. Are people important to  
18 safety?

19 A. Of course.

20 Q. I am answering my own question.  
21 People are a component of a safety system?

22 A. A system, you define your boundaries  
23 where the system is. If you want to define the  
24 boundaries just around a mechanical electrical system,  
25 then that's the system you are talking about. If you

1 want to define your boundaries wider than that to  
2 include the designers, the manufacturers, the  
3 constructors, then that's your system. So really you  
4 have to tell me what is a system and that's the system  
5 in a very general use of the word, and then I can tell  
6 you what is inside of that.

7 But yes, the human element is very  
8 important.

9 Q. I very likely asked the question  
10 badly. But if I were answering my own question I would  
11 say that good safety was a matter of 50 per cent people  
12 and 50 per cent processes and equipment?

13 A. In the end you could probably justify  
14 a higher number than 50 per cent for the human element  
15 in that it is the humans who design the equipment and  
16 manufacture the equipment, so ultimately if there is  
17 some failure that occurs, you can normally trace it  
18 back to some human failing.

19 Q. Okay. I don't want to go that far  
20 back. Let's just stick to Ontario Hydro people.

21 So, Ontario Hydro people are important in  
22 a safety system?

23 A. Yes.

24 Q. I am just confirming what you said.

25 A. Generally, yes.



1 Q. Is their level of morale important?

2 A. It isn't just one group of people, so  
3 if you are talking about morale of everybody or morale  
4 of a small group of people, it could be different.

5 Q. We will start with everybody.

6 A. Well, I would think morale is a  
7 contributor to good human performance and hence  
8 morale --

9 Q. Could you give me a measurement of  
10 your use of the phrase "contributor"? We have already  
11 said that people are maybe 80 per cent of safety. Now,  
12 I am applying that to your comment where you said that  
13 people are probably more important than equipment and  
14 process.

15 A. Well, I didn't say that. I said you  
16 could probably trace any failing in equipment back to  
17 some human failing.

18 Q. I was referring to where you said  
19 that people were probably more important than equipment  
20 or process?

21 A. I guess the record will show whether  
22 I said that. I don't recall saying it in exactly those  
23 words.

24 MR. WRIGHT: I am at a loss here. How  
25 does this system work, is there instant replay?

1 THE CHAIRMAN: Well, I don't think it  
2 matters, Mr. Wright. I think you are asking the  
3 questions, the questions have been answered and I think  
4 you should go on the next question.

5 MR. WRIGHT: Q. Let's assume that what  
6 you said - let me assume that what you said was that  
7 people are more people than equipment and processes,  
8 and for the sake of my questioning let's make it 60 per  
9 cent not 80 per cent.

10 Now, let's take that 60 per cent --

11 THE CHAIRMAN: I think it is very  
12 difficult to quantify these very abstract concepts, Mr.  
13 Wright. Morale is clearly an important factor in any  
14 enterprise, but how you measure it, I don't think  
15 anybody can answer that question.

16 MR. WRIGHT: I know. And an awful lot of  
17 time is being put on trying to improve it and trying to  
18 measure it so if you can see if your methods of  
19 improving are working or not. Thank you.

20 Q. Let's assume then that it is a touch  
21 more important than equipment and process, is the  
22 morale of the people, is that important in the  
23 execution of good safety?

24 MR. KING: A. As I just said, I think it  
25 is an important contributing factor but I am afraid I

1 can't quantify that into any per cent.

2 Q. Would you feel that you would find  
3 more accidents in an unhappy work group than in a happy  
4 work group?

5 I don't mean Mickey Mouse happy, I mean  
6 solid, hard-working group?

7 A. I have no statistics to support that,  
8 but it would seem reasonable to me. I have no  
9 experience in studying two different work groups with  
10 different levels of happiness, but like I said, it  
11 would seem reasonable.

12 Q. Are you aware that there has been a  
13 series of reports over approximately 10 or 11 years  
14 that point out that there is not a generally good level  
15 of morale in Ontario Hydro?

16 A. I am familiar with, I believe they  
17 may be some of your materials which were supplied with  
18 a list of a number of reports, I am not familiar with  
19 the details of these reports. Perhaps somebody else  
20 is.

21 Mr. Daly?

22 MR. DALY: A. I have some familiarity  
23 with some of the reports that you tabled, Mr. Wright.

24 The Collins' report which was issued in  
25 1998, I didn't read the report at time but the major

1 findings were communicated to staff, and I had  
2 previously been a shift supervisor at Pickering so I  
3 was aware of some of the issues and could relate to  
4 them, so I have an interest from that viewpoint.

5 I had not read the Clarke study until you  
6 mentioned it. I had a look at it and it was a  
7 follow-up report to the Collins' report indicating a  
8 number of areas concerned, particularly with the  
9 nuclear operators, and the Hare Commission inquiry I am  
10 generally familiar with that.

11 Q. Would you quarrel with my statement  
12 that it does show, at least in this time frame of '81  
13 through '85, that morale was not the best?

14 A. Yes, I wouldn't generally quarrel  
15 with that.

16 The Collins' report, the majority of the  
17 recommendations -- well, Ontario Hydro sponsored the  
18 report in the first place, so we were aware there was a  
19 problem and we wanted to get something done about it,  
20 and we initiated both the Collins' report and the  
21 follow-up Clarke study. In reading through the  
22 recommendations, the majority of them seemed to have  
23 been either accepted as a new recommendation or were  
24 something that we were looking on anyway. And I think  
25 they characterized reasonable well the problems that we

1       were facing at that time.

2                       There has been many actions taken over  
3       the years, some successful, others we still have a  
4       problem with today and we are addressing through more  
5       up-to-date programs like our quality improvement  
6       process.

7                       Q.   Are you aware of Hare Commission?

8                       A.   I am aware of it, yes.

9                       Q.   Is this quote familiar to you?

10                      A.   Yes.   And perhaps we should read the  
11       quote in.

12                      Q.   I don't know how this system works.  
13       To get these into the transcript, do I need to read  
14       them in?

15                      THE CHAIRMAN:   Well, Mr. Daly is offering  
16       to read that particular quote in.

17                      MR. DALY:   Yes, I wasn't sure everybody  
18       had the quote, but the quote you had made from the Hare  
19       Commission in 1988 was:

20                      I saw much to admire and in no way  
21                      question the zeal, dedication, and  
22                      competence of the nuclear scientists and  
23                      engineers who have designed and run these  
24                      reactors, but I was struck by their  
25                      seeming isolation from other professions



1 and from the general public.

2 That is a direct quote from the Hare  
3 Commission.

4 MR. WRIGHT: Q. Are you aware that the  
5 Hare Commission really didn't seem to find any definite  
6 feel that much had been accomplished from the Collins'  
7 report in this area of general unrest?

8 MR. DALY: A. They did make some  
9 criticisms. They were concerned about the maintenance  
10 backlogs in particular, and they were concerned that we  
11 did not appear to have sufficient staff in some areas  
12 to cope with those maintenance backlogs and that was  
13 putting a stress on the organization.

14 And they did indicate that we should take  
15 further action on that and Hydro since that time has  
16 put in a major hiring program to raise the level of  
17 staff, so we have taken a number of actions as a  
18 follow-up to the Hare Report.

19 [10:26 a.m.]

20 Q. These other quotes that I have on  
21 these pages, do they get into the transcript  
22 automatically?

23 THE CHAIRMAN: They can if we make the  
24 document an exhibit. I suppose that's the way to do  
25 it. Can we give the piece of paper filed by Mr. Wright

1 an exhibit number, please.

2 THE REGISTRAR: 669, Mr. Chairman.

3 THE CHAIRMAN: Thank you.

4 ---EXHIBIT NO. 669: The Collins Report.

5 MR. WRIGHT: Thank you. Is it G for  
6 George?

7 THE CHAIRMAN: No. 669 is the number of  
8 the exhibit.

9 MR. WRIGHT: Q. In 1987 there was an  
10 investigation at Bruce and out of that I understand  
11 there was an unofficial INPO rating given the Bruce  
12 station. Could you tell me what that unofficial INPO  
13 rating was, please?

14 MR. DALY: A. I'm sorry, I couldn't.

15 THE CHAIRMAN: Sorry, what kind of a  
16 rating?

17 MR. WRIGHT: Unofficial. It wasn't --

18 THE CHAIRMAN: Unofficial what kind of  
19 rating?

20 MR. WRIGHT: I-N-P-O.

21 MR. DALY: Yes, the it INPO organization  
22 which is based in Atlanta has a system of rating plants  
23 on a 1 to 5 scale and they do this widely throughout  
24 the U.S. with 1 being the top level and 5 being the  
25 bottom level. INPO visited -- sorry, did you say Bruce

1 "B"?

2 MR. WRIGHT: Q. I didn't specify and it  
3 wasn't an INPO team. It was an in-house team that did  
4 the investigation in the INPO manner and that's why the  
5 rating was unofficial.

6 MR. DALY: A. Okay. Thank you for  
7 clarifying that point.

8 Approximately in 1985 we did have a visit  
9 from a group of INPO staff from the INPO organization  
10 and they did visit Bruce "A" and carry out a technical  
11 exchange with us and showed us how they carried out  
12 their evaluations.

13 Since that time we have done quite a  
14 considerable number of what we call audits, or peer  
15 evaluations is the more formal name, where we use the  
16 INPO technique of auditing, self-evaluation, in an  
17 engineering sense. So we look at the engineering  
18 procedures and processes and that gets into people  
19 issues as well as equipment issues.

20 Following each peer evaluation, there is  
21 a number of recommendations made to line management and  
22 line management follow up on those. There may have  
23 been an unofficial rating on the INPO scale. I don't  
24 recall what the specific one -- as you say it was  
25 unofficial.

1 I guess generally at that period of time,  
2 we were not satisfied with performance of the plant, so  
3 the unofficial rating would certainly not have been in  
4 the sort of higher part of the range, it would have  
5 been in the lower part of the range because we were  
6 concerned with performance and a number of related  
7 issues, and the peer evaluations done in that period of  
8 time generally confirmed it.

9 Many of the recommendations led into the  
10 need for the quality improvement process which was put  
11 in a couple of years ago. So, the outcome of many  
12 reports like the Collins Report, the Clarke Report, the  
13 INPO style evaluations, the branch recognized the need  
14 for greater efforts both on people issues and equipment  
15 issues. And a lot of that came together and became  
16 focussed in the quality improvement process.

17 Q. I'm sorry for this introduction but I  
18 have got to get something across.

19 Years ago when shareholders of  
20 corporations wanted to find out how their companies  
21 were doing, they forced corporations into preparing  
22 annual reports, annual financial statements. It then  
23 got into a book, just staying with the annual financial  
24 statements.

25 As time went on, they began to realize

1 that if management so desired they could lean those  
2 financial statements in various directions and so  
3 evolved a system of auditing, financial auditing, where  
4 third parties say according to a given sets of rules  
5 these financial statements meet those rules.

6 What would your feeling be towards a  
7 request from the Ontario Hydro shareholders, the people  
8 that live in Ontario and use the power, that included  
9 in the annual report there be a third-party audit of  
10 the engineering processes? The chief financial  
11 officers over time have got used to their being  
12 auditors and they co-exist and there are audit  
13 committees and rules as such, so it is not in any way a  
14 condemnation of practices. It is just a way of  
15 communicating with the public how you stand vis-a-vis  
16 the rest of the world I guess.

17 A. I am not convinced that the annual  
18 report would be the best place for that. There are a  
19 few comments in the annual report about the general  
20 performance levels of the stations. We are quite  
21 extensively audited in an engineering sense. We have  
22 had international audits by the OSART Group, the INPO  
23 group that you referred to, we are audited frequently  
24 by the Atomic Energy Control Board and we do a lot of  
25 internal auditing. And various people have from time



1 to time asked ourselves or the AECB for some of these  
2 reports.

3 I think if somebody were interested in  
4 this area, those more detailed reports, some of them  
5 have been made available in the past. These are I  
6 think of more value than trying to put it into an  
7 annual report.

8 MR. PENN: A. I would add, Mr. Wright,  
9 that we have an audit division that spends most of its  
10 time reviewing engineering-related matters and the way  
11 things are done in the company. The senior management  
12 on occasion, and it's not infrequent, call for external  
13 consultants or knowledgeable people to review issues  
14 related to engineering, cost for example. And of  
15 course we have a quality engineering department in  
16 design and construction branch that does the same  
17 thing.

18 Q. I understand what you are saying. I  
19 have no quarrel with what you are saying. I think that  
20 distributing the financial information in the annual  
21 report ended up being done simply as a courtesy to the  
22 public as a kind of an executive summary to the  
23 mountain of work that went on behind the scenes, but it  
24 is still nice to communicate and this would be a way of  
25 communicating to, and let me say us, as to what you are



1 doing. Not everybody has the time or the energy to get  
2 involved in this process to ask you the question to  
3 hear what you just told me.

4 THE CHAIRMAN: I think that's your point  
5 of view, but it's not really a question. I think they  
6 have answered the question of what they would feel such  
7 a matter would be.

8 MR. DALY: Mr. Wright, just before we  
9 leave that, I would just like to give you one  
10 reference. We have actually tabled attached to  
11 Interrogatory 9.2.59 one of the INPO reports. It was  
12 an INPO report on Bruce "A" done in 1986 so that was an  
13 example of the type of report which is here in a public  
14 forum. I think that's typical of the types of INPO or  
15 peer evaluation type reports.

16 MR. WRIGHT: Q. Thank you. Getting back  
17 to Bruce, what was the end result of the fallen pulley  
18 incident.

19 MR. DALY: A. I believe that employee  
20 was dismissed and there were some criminal charges of  
21 some type. I would say that particular incident was a  
22 very severe and abnormal incident and there was  
23 absolutely no excuse for it.

24 But I would not say that is -- that's not  
25 typical of our regular employees. Most employees faced

1 with a difficulty with their supervisor will go through  
2 the appropriate channels, try and resolve it with the  
3 supervisor. There is a grievance process where people  
4 can handle that sort of thing. So, this in my view was  
5 an isolated incident. It is the only one of that type  
6 I can recall in 20 years.

7 Q. From your experience and having read  
8 these various studies in the last day or so, would you  
9 say that the situation in '89 in Bruce was any way much  
10 different from '81. I mean in specific as -- I agree  
11 with you on the pulley incident. I agree with you 100  
12 per cent. But however getting back to what Collins  
13 said in '81, would you say that there had been much  
14 improvement in that area?

15 A. In some areas, yes, some specific --

16 Q. Right. Thank you.

17 A. If I could just clarify. Some  
18 specific changes had been made in terms of first  
19 operator remuneration, trying to streamline the exam  
20 process with the AECB. So I think we can point to some  
21 areas where there had been improvements. There were  
22 others where we for one reason or another fell into the  
23 same trap as before, typically with new people who ran  
24 into the same problems. So, there were still and are  
25 still some problems that we need to address in this

1 area.

2 Q. Thank you. Can you tell me what your  
3 average number per employee and percentage of  
4 implementation is in your suggestion system?

5 A. About two years ago, we put in a new  
6 suggestion system called the TIPS system. It's an  
7 acronym that stands for The Ideas People Suggest. And  
8 it was a little slow getting off the ground at first  
9 but in 1991 we had about 4-1/2 -- I'll just give you  
10 the exact number. In 1991 we had 4,160 suggestions.

11 Q. Okay. There is an international form  
12 of measurement of these systems.

13 A. I was just going to come to that.

14 Q. Sorry.

15 A. So if I take those number of suggests  
16 divided by the total number of employees, we come to  
17 about .14 for 1991 and the acceptance rate of those  
18 suggestions is about 75 per cent. The implementation,  
19 suggestions which are accepted -- some of them as you  
20 go through the implementation, some of them may come  
21 across some problem. But our implementation would be  
22 in the range of somewhere between 50 to 60 per cent  
23 order of magnitude.

24 And you had provided us with some figures  
25 from Dofasco and it seemed to me that our recent

1 figures in the TIPS program were comparable to Dofasco.  
2 They were certainly significantly different from the  
3 Japanese suggestion rates that you had also provided us  
4 with.

5 Q. What did you have before this TIPS  
6 system?

7 A. Well, back in the 70s and I believe  
8 the program was concluded in the early 80s sometimes,  
9 we had a suggestion scheme but it's main problem was it  
10 eventually became too bureaucratic and an employee  
11 would make a suggestion and it just took too long to  
12 get through the red tape before it was implemented.  
13 And there was frustration on both the management side  
14 and the employee's side.

15 [10:40 a.m.]

16 The idea of the TIPS program was to try  
17 and cut through that red tape and bureaucracy and make  
18 it much easier for the employee to have a suggestion  
19 approved quickly. So it's a very simple form. The  
20 employee makes a suggestion, his supervisor reviews it,  
21 contacts the person who would be responsible for  
22 putting it in place, and a decision on acceptability  
23 can be made pretty quickly.

24 The scheme has what we call gold, silver  
25 and bronze awards. So typically if a suggestion is a

1 valuable suggestion, it's accepted, it would normally  
2 be accepted for a bronze award, and then further review  
3 would take place. And if the suggestion was  
4 particularly valuable one, later on it might get a  
5 silver or gold award.

6 Q. Given that people are the majority  
7 part of a successful safety system and that morale is  
8 an important ingredient in it, how do you feel about  
9 the situation as it is?

10 A. I feel very positive about the  
11 situation since the quality improvement process was  
12 initiated within the branch.

13 One of the strong features of the program  
14 is to develop teams to attack problems, and whereas in  
15 the past we might have just had a team of say engineers  
16 only, a much greater effort has been made in this  
17 program to involve union and society staff.

18 As an example, when the vice-president of  
19 the branch went to provide his annual report to the  
20 Atomic Energy Control Board, the chief steward and the  
21 society representative went along to provide part of  
22 that briefing.

23 So we are making it a strong point to  
24 make sure -- I guess the key word here we are focussing  
25 on is involvement, to make sure that the people who are



1 working whether as operators or maintainers, the people  
2 who are working with the equipment on a day-to-day  
3 basis who know what the real problems are, that they  
4 are involved in coming up with a real solutions, and  
5 many of them have contributed very positively to this  
6 program.

7 Q. When did this program start?

8 A. 1990. It's been running about two  
9 years now.

10 Q. So TIPS and the quality improvement  
11 system started at the same time?

12 A. They came in around the same time. I  
13 think that's perhaps not just a coincidence, that there  
14 was a recognition that there were problems we needed to  
15 face up to and improve within the nuclear division, but  
16 some of those reflected the Corporation at large.  
17 Hydro is a big organization and it suffers the hazards  
18 of any large bureaucracy and it is our job to try and  
19 streamline it.

20 Q. Are you aware of reports that predate  
21 the Collins' report saying essentially the same thing?

22 A. I can't think of any external report.  
23 Certainly concerns were growing internally.

24 Appreciate at that time, the Pickering  
25 "A" unit had been running for 10 years, the Bruce unit



1 had only been running for about five years, so we were  
2 beginning to understand what it took to operate a  
3 multi-unit station, and we were gradually recognizing  
4 that to operate a multi-unit station took more staff  
5 than we had originally anticipated. So we were  
6 ourselves learning through this period. But I am not  
7 aware of external reports, just internal.

8 Q. But certainly internally you were  
9 aware that the problem existed.

10 A. Yes. It wasn't a sort of overnight  
11 type of thing. It was a growing type of thing which  
12 became more serious and significant as the amount of  
13 work and stress on the branch as a whole grew over the  
14 years.

15 Q. Given what Dr. Hare said in '88, are  
16 you aware of any time where Ontario Hydro went  
17 specifically outside in senior management to appoint  
18 somebody who may be was not caught up in the same  
19 problem as Hare?

20 You have to accept the fact, I know it's  
21 difficult sitting there accepting it, but you have to  
22 accept the fact that half of what Hare said was very  
23 good.

24 But are you aware of where Ontario Hydro  
25 went out to remedy what clearly had been recognized in

1 the middle to late 70s as a major defect in safety?

2 A. Well, the CRESAP organization had  
3 just been hired around the time of the Hare report to  
4 address a number of those issues, particularly our  
5 organizational structure. The CRESAP organization is  
6 based in Texas and has an international reputation for  
7 doing this type of organizational study. They came in  
8 and did a number of reviews within Ontario Hydro, but  
9 they did a major one within the nuclear generation  
10 division which lead to a number of organizational  
11 changes, for example, we are talked earlier about the  
12 problem with the maintenance backlogs, recommendations  
13 came out of that review, which, incidentally, was a  
14 joint CRESAP/Ontario Hydro review. Some of our staff  
15 were on the team, but there was a substantial external  
16 input from CRESAP. And, for example, the maintenance  
17 groups at the stations were increased in terms of the  
18 amount of maintenance support that was available there.

19 Q. If you take, what do you call it, the  
20 president?

21 A. Ontario Hydro?

22 Q. Yes.

23 A. We have a president and a chair.

24 Q. Let's take the president, and there  
25 is may be half a dozen reporting to him?

1                   A. Vice-president, senior  
2 vice-presidents, probably --

3                   Q. Yes, senior vice-presidents.

4                   A. Probably about four to six senior  
5 ones, yes.

6                   Q. Were there any changes at that level  
7 as a result of by, clearly by '85, that there had been  
8 no real progress, no significant progress? I mean, I  
9 am not denying that there wasn't progress, I am not  
10 denying that they weren't chipping away at the edges,  
11 but significantly there had been no real progress. Was  
12 there any changes at that level then?

13                  A. Well, I wouldn't agree that there was  
14 no real progress.

15                  I think when you look at the details of  
16 some of the changes that were made as a result of the  
17 Collins' report, there were some real changes.

18                  I'm not aware of any changes at the level  
19 that you are describing. There have been obviously  
20 changes over the years, to what extent they were  
21 related to the Collins' report and other reports I am  
22 not aware.

23                  Q. Does it concern you, the morale  
24 problem in safety issue?

25                  A. Well, certainly any morale problem

1 does concern me. It was general concern to the branch  
2 and that's one of the reasons we got into this quality  
3 improvement process.

4 Relating it to safety, I guess I might  
5 make two points there. One, we rely on a defence  
6 indepth approach, so that we have a large number of  
7 barriers, some barriers of which can fail without  
8 leading to unsafe conditions. So, we don't sort of  
9 totally rely on the operator, if you like, and if the  
10 operator fails, you have got a problem. Many of the  
11 systems are automatic.

12 So there is defence indepth and there is  
13 recognition that equipment can fail, people can fail  
14 and no matter what we do there will always be some  
15 equipment failures and there will always be some people  
16 failures, so you have to design to accommodate that.

17 I think maybe the other point I was going  
18 to mention, I certainly agree that if there is low  
19 morale, there tends to be a low level of safety  
20 awareness. So in general, an employee who had low  
21 morale would be less aware and would be less likely to  
22 report problems and deficiencies, and a well-motivated  
23 employee would be much more motivated.

24 Q. You will feel better when the quality  
25 improvement system and TIPS have been in for a while

1 and working well?

2 A. Yes. I think these programs have to  
3 sort of run on a constant basis to be effective. And  
4 we have had two years, we believe we made some  
5 improvement. Certainly the personnel climate, the  
6 relationships between the union employees and the  
7 management, I would say, are significantly better since  
8 we started taking more of a of a team approach and make  
9 sure that we had the right people appropriately  
10 involved.

11 So I think the climate is improving.

12 Q. You mentioned CRESAP, can you spell  
13 that for me, please?

14 A. C-R-E-S-A-P.

15 Q. Where are they? They are based in  
16 Los Angeles? In the States anyway.

17 A. My understanding was Dallas, Texas.

18 Q. Okay. What would 60 per cent of  
19 their market be, their customer base? Who do they work  
20 basically for?

21 A. I don't know very much about the  
22 organization. I know they have studied a number of  
23 other electrical utilities, and one of the reasons they  
24 were chosen was because they had experience in the  
25 electrical utility business. I am afraid that's all I



1 really know about them.

2 Q. Did you meet any of them?

3 A. I didn't personally. I met some of  
4 the -- I was interviewed by one of the teams in my  
5 area, but that particular team was Hydro employees.

6 Q. Could the question be put more  
7 broadly, did any of you others meet with them?

8 MR. KING: A. My understanding of how  
9 the CRESAP came in and looked at all of the Ontario  
10 Hydro organization, they moved from branch to branch,  
11 from design to operations, over a period of a couple of  
12 years, I would imagine. And they set up teams,  
13 composed of both Ontario Hydro staff and CRESAP  
14 management consulting staff, and then they developed  
15 large questionnaires, and I can recall departments of  
16 people would go into a location and they would solicit  
17 opinions from essentially individual in that department  
18 base from filling in this questionnaire, and they would  
19 of course bring together all these responses and they  
20 would be studied by a joint CRESAP and Ontario Hydro  
21 team.

22 But the contact with most of the  
23 individuals, working individuals, their input was  
24 solicited by a questionnaire primarily, and then I  
25 guess occasional interview to selected individuals.



1 Q. Did you meet any CRESAP people?

2 A. I believe I was interviewed but I  
3 can't guarantee whether there was a CRESAP person  
4 sitting in the room at the same time or whether it was  
5 the Ontario Hydro people on that team.

6 Q. This major step into this motivation  
7 issue does not seem to have made terribly many waves at  
8 your levels?

9 MR. PENN: A. Well, I met with Hydro and  
10 CRESAP staff and the design and construction branch  
11 review about three years ago.

12 Q. Do you remember the individual? Was  
13 that person an engineer?

14 A. I don't remember his name. He was an  
15 engineer and a person that was knowledgeable of  
16 organizational structure determined by the situation  
17 that companies may be in at this time. And as Mr. Daly  
18 said, this company assisted Duke Power, in the United  
19 States for example, the major Australian Utility  
20 Commission in Australia that I know of personally  
21 because I spoke to have senior staff in both countries.

22 Q. Do you think there is any danger that  
23 the make-up of CRESAP has been caught in the same web  
24 that Hare remarked of on yourselves?

25 A. I'm sorry, I don't understand your

1 question.

2 Q. Hare made the comment, basically,  
3 that the engineers and scientists involved in Ontario  
4 Hydro were isolated a little from what was going on in  
5 other areas.

6 [10:55 a.m.]

7 Now, I would most likely feel that it  
8 wouldn't just be Ontario Hydro, but this is a  
9 utility-come-nuclear community. I knew a couple when I  
10 lived in Australia, in Canberra, the same dynamic. Do  
11 you think that there is any danger that CRESAP is  
12 locked in this as well?

13 A. I have no idea. I presume Professor  
14 Hare is relating the fact that he felt there was  
15 insufficient contact between scientists and engineers  
16 in Hydro and other engineering professions and the  
17 general public.

18 All I can say is that since 1986 I, and  
19 quite a number of other people, have appeared before  
20 three select committees, which are public, in inquiries  
21 in front of the Ontario Energy Board six times running  
22 in the last six years, and here at this hearing. So, I  
23 feel that we have had some contact with the external  
24 community.

25 Q. I don't think this is the place to

1 expand on this but I don't think that's what Hare  
2 means.

3 Tell me, Ontario Hydro -- this is about  
4 my last question. In the senior ranks of Ontario  
5 Hydro, we have already talked about the president and  
6 the senior vice-presidents but that's two layers.  
7 Where, generally, do you gentlemen fit?

8 MR. DALY: A. I will start off. Senior  
9 vice-president, there are a number of vice-presidents;  
10 below the vice-president there are a number of  
11 directors; below the directors there are a few  
12 managers; and below the managers there are technical  
13 superintendents. That's where I fit in.

14 I might add that over the years there has  
15 been an attempt to streamline the organization, and one  
16 of the things CRESAP suggested was that we try and  
17 flatten our reporting structure --

18 Q. And you are stealing my thunder for  
19 10.

20 A. But we have been making efforts to  
21 flatten the structure a bit.

22 Q. Right. Is there anybody here at the  
23 fourth level: directors?

24 MR. PENN: A. My position is group  
25 manager which is just below director.

1 Q. Fifth. So fifth generally is what we  
2 have got here today?

3 MR. JOHANSEN: A. I am at the same level  
4 essentially as Mr. Daly.

5 THE CHAIRMAN: I'm not sure how this  
6 particular line of cross-examination is going to help  
7 us very much.

8 MR. WRIGHT: I will explain.

9 THE CHAIRMAN: I mean, if you have got  
10 views about management, the time to give those is when  
11 you are giving your evidence. These people can only  
12 answer --

13 MR. WRIGHT: No, there is question, sir.

14 Q. Are you aware if in your own ranks,  
15 and those few above, if there is any either  
16 requirements such as some large corporations have or  
17 strong recommendations that you are involved in active  
18 volunteer work outside of Ontario Hydro and it's  
19 recognized as taking up part of your day's work?

20 MR. PENN: A. Ontario Hydro  
21 encourages --

22 Q. And your day's work is --

23 A. Ontario Hydro encourages staff to  
24 assist in community-related matters. It is normally  
25 done outside working hours but the company grants time

1 off with pay for a number of events of that nature,  
2 including myself.

3 Q. Are you aware of this in the  
4 vice-president and senior vice-presidential level?

5 A. I am not aware of specific details  
6 but I would be amazed if these men and women weren't  
7 involved in supporting community work.

8 MR. WRIGHT: Thank you.

9 Thank you, sir.

10 THE CHAIRMAN: Thank you, Mr. Wright.

11 Mrs. Mackesy.

12 MRS. MACKESY: Good morning. For the  
13 convenience of people following my cross-examination  
14 today, I have prepared a third package of materials.  
15 The clerk has copies for the Board and there are extra  
16 copies on the table at the front of the room.

17 THE REGISTRAR: Is that to be an exhibit?

18 MRS. MACKESY: The former two packages  
19 were not exhibits. This one need not be either.

20 CROSS-EXAMINATION BY MRS. MACKESY (Cont'd):

21 Q. I am moving now to questions on  
22 siting. And the first questions are based on Exhibit  
23 523. It is on the first page of the third package of  
24 my cross-examination materials.

25 This exhibit is a one-page exhibit that

1 Ontario Hydro filed as an errata to page 2-1 of Exhibit  
2 507, the Ontario Hydro document for Panel 9 entitled:  
3 Materials Relating to Environmental Health and Health  
4 Effects of Nuclear Generation.

5 I will read 523 into the transcript. It  
6 begins by saying, the first sentence of the sixth  
7 paragraph on page 2-1 reads:

8 Any future nuclear generation  
9 expansion would likely be on existing  
10 Ontario Hydro-owned sites.

11 And it goes on, Exhibit 523 goes on to  
12 say. It should read:

13 When the time comes in the future to  
14 make base load choices and in the event  
15 that Ontario Hydro does decide to pursue  
16 the nuclear option as a source of major  
17 supply, then it will evaluate candidate  
18 sites identified on page 14-33 of the  
19 Demand/Supply Plan Report, Exhibit 3, as  
20 potentially suitable for development as  
21 well as other potential sites that may be  
22 identified through the site selection  
23 process.

24 And exhibit 523 continues. The rest of  
25 the paragraph is unchanged and reads:



1                   In the event that a new site has to be  
2                   selected the site selection process will  
3                   ensure that the location and  
4                   characteristics of the selected site will  
5                   be such that the impacts will be  
6                   minimized.

7                   I'm not sure to whom I should place  
8                   questions based on this exhibit.

9                   THE CHAIRMAN: Why don't you ask the  
10                  question and they will decide which one should answer  
11                  it.

12                 MRS. MACKESY: Q. My first question  
13                  pertains to the errata, the change in section 2. Am I  
14                  right in thinking that this means that candidate sites  
15                  identified on page 14-37 of Exhibit 3 would definitely  
16                  be evaluated for a new nuclear site but that other  
17                  sites possibly might not be evaluated? In short, might  
18                  only the four sites on page 14-37 be part of the site  
19                  selection process.

20                 MR. PENN: A. No, I don't think you are  
21                  right in assuming that. The sites identified on page  
22                  14-37 of Exhibit 3 are illustrative sites, and the  
23                  environmental assessment process requires a full review  
24                  of alternative sites within the province that can be  
25                  considered. And we have listed over the years a range

1 of pieces of land that may be appropriate for one type  
2 of plant or another.

3 Q. With regard to nuclear, you have  
4 other sites then, in mind right now, that could be  
5 included in the selection process for a new nuclear  
6 plant in addition to these four?

7 A. We have considered other sites in the  
8 past. Whether they would be carried through for a  
9 future nuclear plant needs to be determined on the  
10 basis of final suitability at that point in time. And  
11 I am referring to sites that we have looked at in the  
12 past such as Chats Falls and those on the lower St.  
13 Lawrence River between Kingston and Cornwall.

14 Q. Do you have any on the Lake Ontario  
15 shore west of Pickering?

16 A. Not that I am aware of. Not west,  
17 no.

18 Q. I see. I am thinking of the major  
19 load centres in the Toronto area, you don't have any  
20 sites --

21 A. Not nuclear, no.

22 Q. Okay. What I am getting at is I am  
23 wondering whether these four sites really are sitting  
24 ducks for new nuclear.

25 MS. HARVIE: Mr. Chairman, if I may just

1 address this point. I took a very quick look this  
2 morning at the transcript on January 7th. That was the  
3 notice motion you may recall. It is Volume 96.

4 And my reading of your ruling was that  
5 the reasons why particular sites or lines on a map for  
6 instance were selected were not relevant evidence. Mr.  
7 Campbell gave extensive submissions on the reasons why  
8 we had included certain sites and lines. And this  
9 certainly arose in the course of Panel 7 and objections  
10 were taken at that time about why sites were selected  
11 or not selected or areas shaded or not shaded. So in  
12 my submission I think this is getting into an area that  
13 you have already ruled upon and irrelevant.

14 THE CHAIRMAN: She asked the question  
15 whether there was any predominance to the sites that  
16 were given as illustrative sites, and the answer is no  
17 there isn't. When the time comes, candidate sites will  
18 be identified and there will be hearings held. I think  
19 that's the answer.

20 MR. JOHANSEN: Mrs. Mackesy, perhaps I  
21 can just add one point with reference to Exhibit 3.  
22 I recall being taken through some testimony by two  
23 different parties. And during the course of that  
24 cross-examination we did review three categories of  
25 sites: existing sites; new sites, which we had

1 identified or studied in the past, and Mr. Penn has  
2 mentioned examples; and the third category which would  
3 be new sites which we have not previously studied or  
4 identified. The scope of the environmental assessment  
5 requirement would cover all of those.

6 MRS. MACKESY: Q. I see.

7 Going on then. If nuclear generation  
8 were to be expanded, does the present nuclear  
9 moratorium make existing Ontario Hydro-owned sites more  
10 likely targets for expansion in that less time and cost  
11 and design and construction work might be involved in  
12 getting a plant built than on a new site?

13 MR. PENN: A. My personal opinion is  
14 that the nuclear moratorium has no effect on the extent  
15 to which alternative sites should be considered.

16 Q. Would you please turn to page 17 of  
17 my second package of materials. And this is  
18 Interrogatory No. 929.14. And could I please have a  
19 number. That is page 17, Interrogatory 9.29.14.

20 THE REGISTRAR: 9.9.14.

21 MRS. MACKESY: 9.29.

22 THE REGISTRAR: 9.29.14 is 162.

23 ---EXHIBIT NO. 520.162: Interrogatory No. 9.29.14.

24 MS. HARVIE: Sorry to interrupt, Mrs.  
25 Mackesy. An interrogatory was mentioned this morning

1 during Mr. Wright's cross-examination and an  
2 opportunity was not taken at the time to assign that an  
3 exhibit number. It was 9.2.59 and I wonder if perhaps  
4 we can give it a number before we lose track of it.

5 THE REGISTRAR: 9.2.59 will be 163.

6 ---EXHIBIT NO. 520.163: Interrogatory No. 9.2.59.

7 MS. HARVIE: Thank you.

8 MRS. MACKESY: Q. Now, carrying on with  
9 Exhibit 520.161. In this interrogatory, I asked what  
10 technical and environmental assessment work had been  
11 done on each of the nuclear sites, including existing  
12 sites, new identified sites, and new unidentified  
13 sites.

14 I have one question of clarification  
15 with response to part A, that is, on existing sites.  
16 In the second line, the Bruce HWP extension is  
17 mentioned. Is that Bruce heavy water plant "B"?

18 MR. JOHANSEN: A. No, that is the  
19 extension -- oh, you may be correct. I mean the "B"  
20 plant certainly was part of the extension referred to  
21 here. But at the time of the environmental assessment,  
22 which is referred to, the scope of that expansion was  
23 envisaged as including the "B" plant, the "C" plant  
24 which never got built, and the "D" plant which was  
25 partly built and then stopped.



1 Q. Thank you. And now please turn to my  
2 third package of materials at page 5. This is  
3 Northwatch's Interrogatory 9.6.97 and it has already  
4 been assigned Exhibit No. 520.148. The question asked  
5 about aspects of the natural environment affected by  
6 the nuclear fuel cycle. And in the second paragraph of  
7 the response, Ontario Hydro says, "Environmental  
8 effects studies are in progress for the Bruce and  
9 Darlington sites." And my first question is have such  
10 studies already been done on the Pickering sites?

11 A. Yes, they have.

12 Q. I see. Thank you.

13 A. These are effect studies, I might  
14 just add, based on pre-operational studies expanding  
15 some three years as a minimum typically and  
16 post-operational studies for a further three years at  
17 least.

18 Q. Thank you.

19 Now, before I leave this area, I want to  
20 ask some questions about the four nuclear candidate  
21 sites and I'm not sure whether these are going to be  
22 permitted but I will try them anyway.

23 Were these candidate sites chosen on the  
24 basis of technical consideration and cost? That would  
25 be the North Channel, the Bruce site, the Darlington,



1 and the Wesleyville sites.

2 MR. PENN: A. The location of a  
3 potential site which would be subject to environmental  
4 assessment hearing for a future nuclear plant relates  
5 to a number of characteristics. Design and cost is one  
6 of them, location in the transmission distribution  
7 grid, the implications of load centres and the like are  
8 other matters. So there are many reasons why different  
9 sites are viewed.

10 Q. And in the selection of those sites,  
11 what specific aspects would this panel have worked on  
12 as far as the selection was concerned? The design and  
13 the construction aspect, I suppose, and....

14 A. Well, the sites that were chosen for  
15 illustrative purposes in Exhibit 3 were ones that our  
16 planners chose. And therefore it's a matter perhaps  
17 you should raise with the next panel.

18 Q. Thank you.

19 A. From a design and construction point  
20 of view, I certainly had comments to make upon the  
21 nature of the different sites on the effect on the  
22 design and the construction.

23 Q. Were there other illustrative sites  
24 that you had considered putting forward on the basis of  
25 your input into the Demand/Supply Plan?

1 A. I didn't put any forward, no.

2 Q. Maybe I am misinterpreting. You said  
3 you had input into the design and construction  
4 aspects --

5 A. From the point of view of, as my  
6 direct evidence gave, of illustrating the schedule to  
7 build and the cost to build on an existing or a new  
8 site.

9 Q. Were there any other sites you  
10 thought of for nuclear at that time in addition to what  
11 is in this --

12 A. No, I didn't propose any other sites.  
13 It's not my responsibility.

14 Q. Oh.

15 Now, I believe that the panel told the  
16 North Shore Tribal Council on Wednesday that you have  
17 not identified any areas in the province that would be  
18 excluded from a new nuclear site based on existing  
19 environmental conditions; is that correct? That was in  
20 Volume 143 at pages 25244 to 25245, if you would like  
21 to check it.

22 [11:15 a.m.]

23 MR. JOHANSEN: A. Was that during my  
24 cross-examination, Mrs. Mackesy?

25 Q. Yes, Mr. Johansen, it was.

1                   A. Well, it sounds correct. There  
2 certainly have not been any selections.

3                   Q. Are there any areas of the province  
4 that are excluded from nuclear sites based on other  
5 conditions or criteria?

6                   A. Again, no such constraint mapping  
7 exercise, if that's what you are thinking about, has  
8 been done.

9                   The process of siting for the next  
10 project, CANDU "A" as we call it, had just barely begun  
11 when the moratorium was announced, so everything was  
12 shelved at that point.

13                  Q. Based on those answers, could a  
14 person take the idea, the correct idea away from this  
15 hearing that a site could be considered in the Toronto  
16 area, that no exclusion has been made at this point?

17                  And the basis for my question is going  
18 back to my position at the beginning of the hearing,  
19 namely that the areas which use the electricity should  
20 bear the risks and the impacts and the costs of having  
21 that electricity generated.

22                  A. If you are putting the question to me  
23 it looks like --

24                  Q. Well, I am not sure who on the panel  
25 wants to answer this or could answer it.

1                   A. Well, I guess I could offer a  
2     response from my own environmental perspective and  
3     perhaps Mr. Penn might want to add something.

4                   There are no particular environmental  
5     reasons in principle that would preclude a siting in  
6     the Metro Toronto centre region. However, there, I  
7     would think, would be a number of system planning  
8     criteria, which I can't really speak to with any  
9     expertise, which might very well be the primary  
10    factors, and perhaps I could ask Mr. Penn to comment,  
11    if he is --

12                  Q. May I ask you one point of  
13    clarification before going on to Mr. Penn?

14                  You mentioned that Metro Toronto centre  
15    region. I am thinking of Metro Toronto itself, not a  
16    larger area with bounds that I am not sure of. Would  
17    that change your answer?

18                  A. Well, to the extent that any sensible  
19    siting program will try to minimize direct impact on  
20    the existing land uses, including residential  
21    settlements, it doesn't appear to be an easy option,  
22    just from the point of view of physical displacement  
23    impacts that would very likely result from that kind of  
24    option.

25                  Q. I am interested in your answer

1 because it works against the idea I put forward, which  
2 is the basis for asking this question. Do you want to  
3 turn this over to Mr. Penn now?

4 A. Yes, please.

5 MR. PENN: A. Well, all I would say is  
6 that it is a planning matter, Mrs. Mackesy.

7 Exhibit 523 I think clearly indicates the  
8 answer to you that in the event that Hydro does decide  
9 to pursue the nuclear option as a source of major  
10 supply, then it will evaluate candidate sites  
11 identified on page 14376 of Exhibit 3, as potentially  
12 suitable for development, as well as other potential  
13 sites that may be identified through the site selection  
14 process. And we haven't carried out a site selection  
15 process for another nuclear station. We started to  
16 look at that process, as Mr. Johansen mentioned,  
17 between about May the 15th of 1990, and early November,  
18 before the nuclear moratorium was imposed, but that's  
19 the extent to which we looked.

20 Q. Yes, I appreciate your reply.

21 I think that my concern was arising from  
22 the use of the word "will" evaluate in the case of the  
23 candidate sites listed in Exhibit 3, and only "may", at  
24 other potential sites only may be identified and that  
25 what was one of my concerns.

1                   A. No, it says we will evaluate these  
2 illustrative sites, as well as other potential sites.

3                   Q. That may be identified?

4                   A. That may be identified.

5                   Well, I don't think the word "may be"  
6 means in the sense that you think it does. It's those  
7 that we can't identify by name at the moment because  
8 the site selection process hasn't occurred.

9                   Q. Partly because of the nuclear  
10 moratorium?

11                  A. And the illustrative sites that we  
12 did have there, we either owned them or we had  
13 previously done significant work in the area and we  
14 knew that they had certain characteristics that could  
15 be considered.

16                  Q. And am I right in thinking that the  
17 reason you haven't gone beyond that is because of the  
18 nuclear moratorium?

19                  A. No, we haven't done any more work on  
20 that, we haven't gone beyond that, no.

21                  Q. Because of the moratorium?

22                  A. Because of the moratorium, yes.

23                  Q. Now, Dr. Whillans, this is getting  
24 away from that particular type of matter, but it still  
25 involves sites.



1                   My question for you is my confusion over  
2   the use of the word "local" in collective dose  
3   assessments. And this question is based on Volume 132  
4   of the transcripts, page 23194.

5                   DR. WHILLANS: A. 194?

6                   Q. Yes. Did I say 23? It's 132.

7                   A. Yes, I have that. Thank you.

8                   Q. Okay. At page 23194, the top three  
9   lines, lines 1 to 3, you speak of the local collective  
10  dose assessment and you say:

11                   By most definitions of local, which  
12                   takes it out to a few hundred kilometres.

13                   And I am wondering on what do you base  
14   the statement "by most definitions of local" as  
15   referring to that extensive an area?

16                   A. Well, we could check UNSCEAR 1988,  
17   which was Exhibit 621, but I believe when we were going  
18   through this part of the evidence, I quoted their  
19   definition, which I think is 100 kilometres and the  
20   regional is 1,000.

21                   Then we also get into the question of  
22   whether Ontario Hydro did calculations out to 100  
23   kilometres, and we said that we have a different  
24   definition for environmental dose impact, which is  
25   basically to take it to the point at which the dose is

1 approximately 1 per cent of the fence post, the maximum  
2 dose, and in some cases that's not 100 kilometres, it's  
3 usually quite a lot less. And we talked about the  
4 water supply plants, I think, within 25 kilometres.

5 So I guess I am saying there is an  
6 UNSCEAR definition, we use our own definition which is  
7 more local, and I imagine other jurisdictions or other  
8 companies use different things as well.

9 Q. And in your use of the terms local  
10 and regional, you are using them and applying them  
11 specifically to the dose assessment process, not to  
12 general every day use of the word local?

13 A. That's correct.

14 Q. Thank you. That is what I wanted to  
15 verify.

16 This may be a good point to break, Mr.  
17 Chairman.

18 THE CHAIRMAN: All right, we will break  
19 for 15 minutes.

20 THE REGISTRAR: Please come to order.  
21 This hearing will recess for 15 minutes.

22 ---Recess at 11:27 p.m.

23 ---On resuming at 11:50 a.m.

24 THE REGISTRAR: Please come to order.  
25 This hearing is again in session. Please be seated.

1 THE CHAIRMAN: Mrs. Mackesy?

2 MRS. MACKESY: Thank you.

3 Would you please turn to page 13 of my  
4 second materials package, and this is Interrogatory No.  
5 9.29.10.

6 Could I have an exhibit number for that,  
7 please.

8 THE REGISTRAR: 9.29.10, is .164.

9 ---EXHIBIT NO. 520.164: Interrogatory No. 9.29.10.

10 MRS. MACKESY: Thank you.

11 Q. My question in the interrogatory was:

12 Why were the proposed nuclear  
13 generation sites not placed in major load  
14 centres?

15 And the reply was:

16 Sites discussed in the demand/supply  
17 planning document were chosen for  
18 illustrative purposes only. No sites  
19 were proposed, no nuclear generating  
20 stations have been selected and the  
21 selection of sites will depend on a  
22 number of criteria one of which is  
23 proximity to major load centres.

24 Did anyone on the panel prepare this  
25 reply?

1 MR. PENN: A. No, but, before the break,  
2 I believe, that essentially paraphrases what I stated  
3 in testimony.

4 Q. Yes. Now, if I were to ask for a  
5 clarification of some of the terms in this reply, such  
6 as what is meant by proximity or what is meant by major  
7 load centres, would those be Panel 10 matters, or could  
8 someone on this panel speak to them?

9 A. Well, from my point of view I think  
10 they would, because I can offer my own personal opinion  
11 on what load centres means and proximity, but I can't  
12 do anything else.

13 Q. So it's a Panel 10 matter?

14 A. Yes.

15 Q. Thank you.

16 And now would you turn to page 16 of the  
17 second materials package, please, and this is  
18 Interrogatory No. 9.29.13.

19 THE REGISTRAR: 9.29.13, is .165.

20 ---EXHIBIT NO. 520.165: Interrogatory No. 9.29.13.

21 MRS. MACKESY: Thank you.

22 Q. In that interrogatory I asked in  
23 Exhibit No. 3, the Demand/Supply Plan report, page  
24 14-37, line 24:

25 Under the heading candidate sites for

1 nuclear options, Ontario Hydro describes  
2 Bruce "C" as reasonably close to major  
3 load centres.

4 My question was: By what standard is  
5 Bruce "C" reasonably close to major road  
6 centres?

7 The reply was: Bruce "C" is reasonably  
8 close to major load centres in  
9 Southwestern Ontario, and Bruce "C" is  
10 also closer to major load centres and the  
11 source of electricity for the Manitoba  
12 Purchase and is closer than many  
13 potential hydroelectric generation sites  
14 in Northern Ontario.

15 And if I wanted clarification of some of  
16 the terms in that answer, should I again look at Panel  
17 10.

18 MR. PENN: A. I think so, I can't add  
19 anything to the response.

20 Q. Thank you.

21 My next question is based on page 4 of my  
22 third package of interrogatory materials. This is the  
23 new package that was handed in this morning. This page  
24 is a copy of page 2 of Ontario Hydro's 1990 report  
25 entitled: The Bruce Nuclear Power Development

1 Radioactive Waste Operation Site 2, Safety Report. The  
2 report was attached to Interrogatory 9.7.34, and that  
3 interrogatory was assigned Exhibit No. 520.116,  
4 although a different attachment was referred to at the  
5 time.

6 Mr. Chairman, I am wondering, should this  
7 document also be numbered as Exhibit 520.116?

8 THE CHAIRMAN: I think that would be  
9 satisfactory.

10 MRS. MACKESY: Thank you.

11 Q. Now, looking at page 2 of the report,  
12 page 4 of my materials package, under the heading about  
13 five or six lines down the page, Favourable Site  
14 Characteristics Are, point 2 is listed as location  
15 remote from population centres. This statement seems  
16 to be expanded upon farther down the page under the  
17 heading Population. I will read the two paragraphs  
18 under population into the transcript.

19 The location of the BNPD site relative  
20 to population centres and geographic  
21 features within a 40 kilometre radius is  
22 shown on Figure 2-2. This area is  
23 primarily rural and there is no single  
24 major urban centre in the region. The  
25 urban population is mainly dispersed



1 among five towns and five villages as  
2 shown in table 2-1. The table summarizes  
3 the existing population based on the 1985  
4 Bruce County census. The present  
5 regional population distributed within  
6 100 kilometres is presented in figure 2-3  
7 which is based on standard 22.5 degree C  
8 sectors with segments of radial  
9 increments from the centre of the site.  
10 Figure 2-3 shows that approximately 1,350  
11 people live within the first eight  
12 kilometres of the site, and 40,000 within  
13 the 40 kilometre radius including the  
14 Town of Walkerton which is 42 kilometres  
15 to the southeast. The regional  
16 population within 100 kilometres radius  
17 is approximately 215,000. The regional  
18 population projections are shown in  
19 figures 2-4 and 2-5.

20 I am not going to read the second  
21 paragraph, it goes into the projection up to 2015,  
22 except to read the final sentence:

23 The population of the year 2015 is  
24 estimated to be about 50,800 based on the  
25 assumption that the region will grow at

1 an average annual compound rate of .8 per  
2 cent from 1985 to 2015.

3 Now, my question is, in describing the  
4 Bruce Nuclear Power Development as being a location  
5 remote from population centres, does Ontario Hydro mean  
6 by this that it is far enough away from major  
7 population centres, that the populations in those load  
8 centres feel safe even if a major accident should  
9 happen that affected the local population in the Bruce  
10 area?

11 MR. JOHANSEN: A. My interpretation of  
12 this, Mrs. Mackesy, is that this population centre  
13 remoteness factor is more focussed on avoiding obvious  
14 land use conflicts. As we have already indicated in  
15 previous testimony, no matter where we locate our  
16 nuclear facilities, they have to meet the derived  
17 emission limits and our own operating targets at the  
18 site boundary. So there is no particular advantage in  
19 seeking remote locations from that point of view, but  
20 obviously, when siting any facility, if you look for  
21 areas which are not heavily developed already, it would  
22 appear easier to locate a site avoiding important  
23 conflicts.

24 Q. The deciding point here seems to be  
25 number of population. Are you equating number of

1 population with development in your answer?

2 A. There would be a relationship, yes,  
3 between the numbers of people living in an area and the  
4 extent of development in terms of land use, whether  
5 it's for residential, commercial or industrial  
6 purposes. And the data which is presented here is data  
7 which is used for both environmental and safety  
8 analysis purposes.

9 Q. Could though this distance from the  
10 large population centres make it more attractive to  
11 people in those centres, make nuclear generation more  
12 attractive to people in those centres because they are  
13 not living so close to, in this case, the waste  
14 disposal facilities associated with the generation?

15 A. Well it's difficult to answer. I  
16 guess it's a matter of personal perception.

17 I suppose if an individual is unaware of  
18 some industrial activity, it probably follows that  
19 there is also a commensurate lack of awareness of risks  
20 or benefits, indeed. But that would be a highly  
21 individual perception, I would think.

22 [12:00 p.m.]

23 Q. When you are locating a waste  
24 disposal facility, do you take into account the idea I  
25 have just mentioned, that the general population might

1 be more accepting of it if it isn't too close to them?

2 A. Well, the general public --

3 Q. I am speaking here of the large  
4 population centres that BNPD is presumably removed  
5 from.

6 A. I understand that.

7 I think the concept of general public  
8 opinion is something that is looked at at the early  
9 planning stage but it's less useful when the project  
10 enters what we call the definition phase or siting  
11 phase at which time you really have to deal with the  
12 concerns and perceptions of the people who are  
13 potentially going to be affected.

14 And the key to that is to incorporate  
15 consultation with those members of the public and  
16 groups in the planning process. And I think we have  
17 already indicated in testimony of this panel that we  
18 consider that important and I believe Ms. Quinn, during  
19 Panel 6, spoke at some length about the general  
20 planning process and the incorporation of social impact  
21 analysis in that context.

22 Q. One last question related to this  
23 topic. The BNPD waste operation site takes waste from  
24 the Pickering site; is that correct?

25 A. Yes, it does. And Darlington.

1 Q. And Darlington.

2 Are there any waste management facilities  
3 at Pickering?

4 A. Temporary storage pending ultimate  
5 transportation to BNPD. The general plan with all low  
6 and intermediate level wastes, as I indicated in my  
7 direct evidence, is to move that waste to the Bruce  
8 site. The main exception is the retubing waste which  
9 would stay at the individual reactor sites until that  
10 facility is ultimately decommissioned and it would then  
11 be disposed of together with the rest of the materials  
12 resulting from the decommissioning of the facility.

13 Q. And when you say the low and  
14 intermediate wastes are moved to the Bruce site, you  
15 are speaking there of the Bruce site as a management  
16 site and not as ultimate disposal site for low and  
17 intermediate waste?

18 A. That's correct. I am talking about  
19 the reactor or radioactive waste operation site.

20 Q. Carrying on from that. Has there  
21 been, in your contact with the people around Pickering,  
22 any wish to have the reactor retubing component parts  
23 moved to Bruce as well?

24 A. I am not aware of the details but  
25 there has been a survey and there may have been actual



1 discussions through the community relations office at  
2 the Pickering site with the communities around the  
3 Pickering site recently - I'm thinking within the last  
4 couple of years - for purposes of determining what the  
5 level of public concern was around the Pickering site  
6 with regards to these waste management storage  
7 operations.

8 And although I haven't seen the report on  
9 the subject, my advice is that the Atomic Energy  
10 Control Board, at least, has assessed the information  
11 which was submitted to them and concluded that there  
12 was not a great deal of concern about it and indeed  
13 there wasn't all that much concern about the operation  
14 of the plant as a whole and that people tended to  
15 associate it as simply another part of the operation  
16 which they presumed was being handled responsibly by  
17 Ontario Hydro and monitored by the regulator.

18 Q. If it develops that there were a  
19 concern about that material, retubing material, being  
20 stored on the Pickering site and as a result it was  
21 moved to the Bruce site, would that be an example of  
22 what I spoke of at the beginning of my questions on  
23 this page of people in larger population centres  
24 feeling safe once they got material out of their area,  
25 got it into an area some distance away from them?



1                   A. Well, I can't really answer that.

2           I think it's hypothetical.

3                   THE CHAIRMAN: I don't think he can  
4           answer that question. There is too speculative a basis  
5           for it and I don't think it is a question he can  
6           answer.

7                   MRS. MACKESY: Very well.

8                   Q. Now, I would like to move to some of  
9           your testimony, Mr. Penn, and I believe this was during  
10          Energy Probe's cross-examination that you were asked  
11          whether it was your view that building a second plant  
12          at the Darlington station would increase the risk of a  
13          nuclear accident in this area. Am I right that you  
14          agreed that it would?

15                  MR. PENN: A. Well, I don't recall being  
16          asked that question. I don't know whether Mr. King was  
17          asked that question.

18                  Q. I may be wrong and I might have to  
19          check this over the lunch break. This was in  
20          connection with the Goldfarb report.

21                  A. Yes, I remember the Goldfarb report.

22                  Q. I will come back to that later then.

23                  THE CHAIRMAN: Perhaps you can ask the  
24          question you want to ask Mr. Penn now, whatever it is  
25          you want to ask him about it.

1 MRS. MACKESY: Q. I wanted to use that  
2 as the basis and then go on from there.

3 MR. KING: A. There is no doubt that if  
4 you increase the number of reactors at any site the  
5 risk to a single individual on the boundary increases,  
6 and in fact that is how we determined the allowable  
7 risk from a given reactor. We set the risk based on an  
8 individual boundary and then divided by the number of  
9 reactors at the site so hence the risk to an individual  
10 reactor is lower. Have I have explained it clearly?

11 Q. I am not sure I follow that.

12 A. You consider the number of reactors  
13 on a site when trying to calculate the risk to an  
14 individual on the boundary because it is a factor of  
15 the--

16 Q. Yes.

17 A. --number of reactors you have on a  
18 site. I recall that discussion. I forget whether it  
19 was with me or Mr. Penn, with Mr. Poch, and I believe  
20 it came out at that time, did it not?

21 Q. That's a different -- I believe  
22 that's different from what I am referring to.

23 Anyway, I will start from something that  
24 you have been telling me. You agree that the building  
25 of a third plant then at BNPD would increase the risk

1 of a nuclear accident?

2 A. I thought your question was on  
3 Darlington. It depends how --

4 Q. The material which I am going back to  
5 was with relation to Darlington and building a second  
6 plant.

7 A. It depends on whether the individual  
8 is the same individual. At Darlington the situation  
9 where if there was another plant built there, it would  
10 most likely be built right next to the four units, just  
11 as Pickering, continuing the line, continuing the line.  
12 And hence the individual most at risk would be the same  
13 individual.

14 However, at Bruce or any other site where  
15 you have considerable distance between the individual  
16 reactors it may not necessarily be the same individual.  
17 But if they are very closely together like at  
18 Pickering, for example, then, we would consider all the  
19 risks additive.

20 Q. I think what is happening here is  
21 that we are using risk in a narrow sense. And what I  
22 am getting at is if you put three reactors rather than  
23 two in an area, just because there are three rather  
24 than two, is there a greater probability or possibility  
25 of an accident?

1 A. Yes.

2 Q. Thank you. Has a third plant been  
3 suggested for any candidate site other than BNPD?

4 MR. PENN: A. Well, Mrs. Mackesy, a  
5 third plant hasn't been suggested for BNPD. It is just  
6 one of the illustrative sites that would be considered.

7 Q. If it were built there, has there  
8 been a third plant -- I'm going back. Has there been a  
9 third plant suggested for any other illustrative site?

10 A. There hasn't been a third plant  
11 suggested for any site.

12 Q. This is getting rather strange, I'm  
13 sorry. Would you explain that, please.

14 A. Well, we haven't suggested, for  
15 example, a third plant at Pickering because there isn't  
16 area, there isn't room for a third site at Pickering.

17 The future nuclear plants in CANDU "A" in  
18 particular as I have said earlier, before the break, we  
19 were going through the process of putting together an  
20 environmental assessment of four certain illustrative  
21 sites and we would be looking at other potential sites  
22 in the province to show whether they should be  
23 considered or whether they had characteristics that  
24 meant that they were unsuitable.

25 Now, Bruce was one of the illustrative

1 sites, but we haven't got to the point of suggesting  
2 where the next nuclear station should be.

3 Q. Am I right in taking that Bruce "C"  
4 is an illustrative site for a possible new nuclear  
5 generating station?

6 A. It's a potential site for  
7 consideration sometime in the future, yes.

8 Q. Thank you.

9 Now, going back to Mr. King. Does the  
10 presence of a waste disposal site at BNPD with the  
11 incinerator and the expanding waste storage facilities  
12 further add to the possibility of a nuclear accident?  
13 I won't say risk.

14 MR. KING: A. Well, I will probably ask  
15 Mr. Johansen to add something if he would like, but I  
16 think we are just talking about the accidents that can  
17 happen at a nuclear station and any incident that can  
18 happen at a waste site are so different in nature that  
19 I think it is hard to compare one with the other.

20 Q. If you have a waste site and one,  
21 two, three nuclear stations on the same general  
22 development site, does that increase the possibility of  
23 a release of radioactivity as you add more and more  
24 radioactive facilities?

25 A. Hypothetically, yes--

1 Q. Thank you.

2 A. --with more facilities. But maybe I  
3 will ask Mr. Johansen if he chooses he may want to  
4 comment.

5 MR. JOHANSEN: A. Yes. I suppose two  
6 points. One would be that you referred to the site as  
7 a disposal site and I think--

8 Q. I am wrong.

9 A. --we earlier agreed that it was not a  
10 disposal site.

11 And secondly, I think whenever Ontario  
12 Hydro proposes to add additional facilities to an  
13 existing site, part of the trade-off or part of the  
14 requirement that goes along with that would be more  
15 stringent design requirements, emission requirements,  
16 so that the total impact of the facilities at that site  
17 are still within acceptable limits.

18 That might indeed require some  
19 improvements with the existing facilities such that the  
20 combined impact remains acceptable. There have been  
21 examples of just that sort of "B" project impact on the  
22 existing "A" project in the past.

23 Q. What you are saying is that you would  
24 increase the, I suppose what's generally called the  
25 safety systems, and hope that people accept that as a



1 trade-off?

2 THE CHAIRMAN: No, that's not what he  
3 said, but I don't want to ask him to repeat it again.  
4 He didn't talk about safety systems, I don't believe.

5 MR. JOHANSEN: That's correct, Mr.  
6 Chairman. I was talking about--

7 THE CHAIRMAN: Exposure to radioactivity.

8 MR. JOHANSEN: --environmental emission  
9 control performance and other non-radiological impact  
10 controls.

11 MRS. MACKESY: I will leave that then.

12 Q. Now, my final question on this  
13 portion was: Considering the accumulation over time  
14 and suggestions for future expansion of nuclear  
15 generation and support facilities at BNPD, would you  
16 agree that the Bruce Nuclear Power Development is an  
17 example of the adage "Give them an inch and they will  
18 take a mile" as far as describing Ontario Hydro  
19 activities in the area is concerned?

20 THE CHAIRMAN: I don't think you need to  
21 answer that question either.

22 MRS. MACKESY: Very well.

23 Q. Now, this is coming back to Bruce "C"  
24 site and it may be considered too site specific, but I  
25 will put the question any way.

1 In Panel 6 we heard a lot about exempting  
2 parklands from hydraulic generation developments. And  
3 now would you please turn to page 29 of my second  
4 materials package. And this page again is taken from  
5 the Bruce Nuclear Power Development Radioactive Waste  
6 Operation, Site 2, Safety Report. That is Exhibit  
7 520.116.

8 And on page 12 of that report, 29 of my  
9 package, the last three paragraphs are on recreation  
10 resources in Bruce County, and I am going to read the  
11 second paragraph into the transcript:

12 "On June 7, 1973, the Ontario  
13 Government announced an agreement between  
14 Ontario Hydro and the Ministry of Natural  
15 Resources that gave ownership of  
16 Inverhuron Park to Ontario Hydro in order  
17 that safety considerations required for  
18 compliance with the Atomic Energy Control  
19 Board siting guidelines with respect to  
20 the Bruce Heavy Water Plant could be  
21 implemented. However, the Ministry of  
22 Natural Resources continues to operate  
23 the southern portion of Inverhuron Park,  
24 on a lease-back arrangement with Ontario  
25 Hydro, leaving the picnic areas and beach

1 available to the public for day-use only.

2 The use of Inverhuron Park is subject to  
3 the requirements of the regulatory  
4 authorities. A portion of a northern end  
5 of the park lies inside the exclusion  
6 radius of the BNPD site."

7 Could anyone on the panel confirm that  
8 this 1973 change regarding Inverhuron Park was  
9 controversial and that there was some intense local  
10 opposition to the change?

11 THE CHAIRMAN: Sorry, what was the change  
12 you are referring to? What was the change?

13 MRS. MACKESY: Going back to the  
14 beginning of the paragraph on page 12 --

15 THE CHAIRMAN: You mean the agreement  
16 itself?

17 MRS. MACKESY: Yes, the agreement itself.

18 THE CHAIRMAN: There was opposition to  
19 the agreement.

20 MRS. MACKESY: Yes, opposition to the  
21 agreement.

22 [12:20 p.m.]

23 MR. JOHANSEN: Well, I don't claim to be  
24 the absolute authority on the subject, but I do recall  
25 at the time that I was coordinating the environmental

1 assessment of the Bruce "B" generating station, that  
2 there was this new siting guide from the Atomic Energy  
3 Control Board which came along sometime after the "A"  
4 plant had already been built. And it did impose on  
5 Ontario Hydro the requirement to control population  
6 development within I believe it was a five mile radius  
7 around the plant, and that was the context of Ontario  
8 Hydro, in effect, being required to obtain ownership of  
9 Inverhuron Park. And in that connection I think it is  
10 important to read that third paragraph as well, which  
11 refers to MacGregor Point Park, because that was part  
12 of the deal.

13 MacGregor Point Park, a larger park than  
14 Inverhuron in terms of camping facilities at least, was  
15 provided to compensate for the loss of overnight  
16 camping facilities in Inverhuron Park.

17 Q. Would you agree though that that did  
18 not do away with the opposition towards the way  
19 Inverhuron Park was --

20 A. Yes, I was going to get back to the  
21 point of your question. I frankly don't recall a lot  
22 of opposition, but at same time I wouldn't suggest that  
23 there was no opposition. I can well imagine that there  
24 would have been some concern.

25 Q. Going back to the second paragraph,

1 the last sentence:

2 A portion of the northern end of the  
3 park lies inside the exclusion radius of  
4 the BNPD site.

5 Is that the five mile -- I am sorry, the  
6 five kilometre radius -- did you say five miles or five  
7 kilometres, I'm sorry?

8 A. Five miles.

9 Q. Is that the exclusion, is that the  
10 area that you were speaking of?

11 A. No. Mrs. Mackesy, when I talk about  
12 the five mile zone that is a zone centered around the  
13 heavy water plant. The exclusion radius is a very  
14 specific exclusion zone around the nuclear reactor. I  
15 believe that what is referred to here is the exclusion  
16 zone around the closest reactor of the Bruce "B"  
17 nuclear plant which does sweep into the northern part  
18 of the park, as it says.

19 Q. So then one final point of  
20 clarification, when you are referring to the five miles  
21 around the heavy water plant, that took in all of the  
22 Inverhuron Park area; is that correct, based on what  
23 you have been telling me?

24 A. I am not absolutely sure just where  
25 that falls. Inverhuron Park is a substantial area and

1 I, offhand, can't tell you just where that radius  
2 falls.

3 I have information in the suite which I  
4 could dig out if you need to have a specific answer on  
5 that.

6 Q. Perhaps after lunch you could?

7 A. I could provide that, yes.

8 Q. This is the question that might be  
9 refused.

10 Since Bruce "C" is described as an  
11 existing site, although illustrative, could anyone tell  
12 me whether it would be situated -- where it will be  
13 situate in relation to Bruce "A" and "B"; that is,  
14 would it be south of Bruce "A" in Inverhuron Park, or  
15 would it be somewhere else?

16 THE CHAIRMAN: I think they have already  
17 given testimony that they have no idea where it will be  
18 sited, if at all. So I don't know how they could  
19 answer that question.

20 MRS. MACKESY: Okay.

21 Q. Next I want to question a response to  
22 Interrogatory 9.29.9, and this is at page 11 of my  
23 second package.

24 Could I have an exhibit number for that,  
25 please, 9.29.9.



1 THE REGISTRAR: That will be .166.

2 ---EXHIBIT NO. 520.166: Interrogatory No. 9.29.9.

3 MRS. MACKESY: Thank you.

4 Q. My interrogatory question was:

5 In the mid 1980s what reasons did  
6 Ontario Hydro give for the surrounding  
7 area not using locally the locked-in  
8 energy at the Bruce Nuclear Power  
9 Develop?

10 As a word of explanation, my question was  
11 based on my memory of the local social environment  
12 around BNPD that had been described in the mid 1980s  
13 Ontario Hydro environmental assessment, and I wanted to  
14 get that on the record through the interrogatory  
15 process.

16 Now, the reply I was anticipating was in  
17 Volume 1 of the 1985 Ontario Hydro Southwestern Ontario  
18 Transmission Study Environmental Assessment, page 66,  
19 and a photocopy of that appears on page 12 of my second  
20 package of materials.

21 THE CHAIRMAN: Is this your follow up or  
22 Hydro's follow up?

23 MRS. MACKESY: This is my follow up, Mr.  
24 Chairman.

25 I received the answer to 9.29.9 in

1 November and in late December I wrote Ontario Hydro  
2 including a photocopy of the answer I expected and  
3 asked what was the relationship between the information  
4 in the 1985 Southwestern Ontario Transmission Study  
5 Environmental Assessment and the answer I received in  
6 November.

7 THE CHAIRMAN: What has this got to do  
8 with nuclear generation?

9 MRS. MACKESY: I was trying to get on the  
10 record the social environment around the Bruce Nuclear  
11 Power Development and contrasting that with the amount  
12 of generation in a centralized nuclear development.

13 Shall I proceed with this?

14 THE CHAIRMAN: I am not sure I follow  
15 you, but why don't you ask them a question.

16 MRS. MACKESY: Q. I will read the  
17 extract from the 1985 environmental assessment and then  
18 read the answer I got in November and ask my question.

19 MS. HARVIE: Maybe I will save you the  
20 trouble, Mrs. Mackesy. We did take a look at this  
21 interrogatory, Mr. Chairman, and as I advised Mrs.  
22 Mackesy in a meeting that I had with her I guess before  
23 we started this panel, that following the scoping  
24 session, our view of this matter was that the  
25 Southwestern Ontario Hydro Transmission hearing held

1 over a two-year period between 1985 and 1987, the Joint  
2 Board dealt with the issue of locked-in power at Bruce  
3 and that in fact is one of the major reasons why  
4 approval was given to new transmission lines.

5 I would submit that the whole matter is  
6 completely irrelevant to any determination you have to  
7 make with respect to the Demand/Supply Plan.

8 MS. PATTERSON: Is your argument, Mrs.  
9 Mackesy, that again centralized power that requires  
10 transmission basically.

11 MRS. MACKESY: Yes. Or centralized power  
12 that brings the impacts of centralized power generation  
13 to a small area for the benefit of the large.

14 I have one further problem in that I have  
15 a concern about leaving the answer as it stands in the  
16 November answer without challenging it, because I would  
17 like to -- I disagree with it and I would like to try  
18 to understand what it means.

19 MS. HARVIE: I don't think you are going  
20 to find that these witnesses are able to give evidence  
21 about this. This is clearly a transmission line  
22 question, and one which, in fact, I think you put to  
23 Dr. Macedo on Panel 7. You asked whether adding  
24 additional generation to the Bruce power plant would  
25 require additional transmission, and Dr. Macedo

1       responded that it would.

2                       So, in my submission, Mr. Chairman, the  
3       question has been asked on the appropriate panel and  
4       the response given. I don't know how these witnesses,  
5       in any event, would be able to respond to what are  
6       clearly system planning and transmission planning  
7       questions.

8                       MRS. MACKESY: May I respond once more.

9                       The section of the Southwestern Ontario  
10      Transmission Study Environmental Assessment that I have  
11      copied refers to local energy utilization. And it  
12      speaks to how the population at Bruce county, this was  
13      the mid 80s, was approximately 60,000 per cent, 40 per  
14      cent urban, 60 per cent rural, only 3 per cent of that  
15      of Metropolitan Toronto. The major other land use near  
16      the Bruce Nuclear Power Development being agricultural.  
17      And explaining that that area could not use the amount  
18      of power that was being generated at Bruce.

19                      So that to my way of thinking, even  
20      building transmission lines just within that area would  
21      not have used up that power.

22                      The answer I got in November, no  
23      transmission lines were available to carry the energy  
24      to any areas where it could be used, does not seem  
25      to -- I don't understand that in the context of local

1 energy utilization. Even if they built the lines just  
2 locally, there is of they are still not going to be  
3 able to use up the power.

4 MR. HARVIE: That may be, but these  
5 witnesses can't answer that question. It's clearly a  
6 system planning and transmission planning question.

7 MRS. MACKESY: Very well.

8 THE CHAIRMAN: I think we have to leave  
9 it that way, Mrs. Mackesy.

10 MRS. MACKESY: Yes, I have my concerns on  
11 the record. Thank you.

12 THE CHAIRMAN: I think we all understand  
13 that the position that you are taking, which is a  
14 position which we will have to give consideration to,  
15 but this is cross-examination and the purpose of  
16 cross-examination is to get what these witnesses can  
17 contribute to the hearing, it isn't to argue the pros  
18 and cons of the issues.

19 MRS. MACKESY: Q. Now, I am moving to  
20 some transmission questions, but I believe they arise  
21 out of the evidence given by this panel.

22 For my first question, would you please  
23 turn to page 18 of my second interrogatory package.  
24 This is Interrogatory question 9.29.15.

25 THE REGISTRAR: That's .167.



1       ---EXHIBIT NO. 520.167: Interrogatory No. 9.29.15.

2                       MRS. MACKESY: Thank you.

3                       Q. It's Page 18. Now, this question was  
4       based on a newspaper article arising out of an Ontario  
5       Hydro information centre on the DSP held in Owen Sound,  
6       and I will read the lengthy question and the short  
7       answer into the transcript.

8                       The question had the following  
9       background:

10                      Regarding relation Bruce "C" to  
11                      existing generating stations at BNPD.  
12                      The February 28, 1990 issue of Owen Sound  
13                      Sun Times (Transmission Lines Plan Being  
14                      Revived) spoke of Ontario Hydro's 25-year  
15                      Demand/Supply Plan as reviving the Bruce  
16                      to Essa power transmission corridor  
17                      because the plan includes the option of  
18                      building a third nuclear station at BNPD.  
19                      Hydro spokesman, Doug Armour, is  
20                      described as emphasizing that the nuclear  
21                      construction at Bruce isn't likely until  
22                      well into the next century, and that  
23                      though a new line was unlikely in the  
24                      case of a new Bruce station being built,  
25                      it had to be included as part of the



1 notice as insurance. The reason given  
2 for the line being unlikely was that the  
3 original reactors at Bruce "A"  
4 generating station will likely have  
5 reached the end of their productive life,  
6 and 'we wouldn't have to build a third  
7 one (transmission line) because we have  
8 already got additional transmission  
9 lines.'

10 My question was:

11 Is it Ontario Hydro's position that  
12 Bruce "C" is real just a replacement of  
13 Bruce "A"?

14 And the response was:

15 Bruce "C" would not necessarily be just a  
16 replacement of Bruce "A". It is highly  
17 unlikely that a new 4 by 881 megawatt  
18 station will be built at Bruce "C"  
19 during the planning period.

20 Could anyone confirm whether that reply  
21 still stands? And if you are uncertain, I don't mind  
22 you saying that.

23 MR. PENN: A. Well, all I can say, Mrs.  
24 Mackesy, is that the Bruce site is being considered for  
25 illustrative reasons. It would be these types of

1 issues that would be included in the project specific  
2 environmental assessment document, given that another  
3 nuclear station will be built in the province.

4 I really can't add much to it except to  
5 remind you I think that earlier this morning that Mr.  
6 Daly gave testimony that out of the Bruce "A" and "B"  
7 stations we generated in 1990 - was it, Mr. Daly - some  
8 31 per cent of the province's generation. And that's  
9 another issue that would have to be taken into account.

10 I can't add any more than that.

11 Q. And the significance of that, Mr.  
12 Daly, I am going to paraphrase and see if you agree,  
13 you have some sort of planning limit on the amount of  
14 generation coming from one particular area into the  
15 system, one particular site into a system; is that  
16 correct?

17 MR. DALY: A. I am not aware of the  
18 system planning limits. We have talked about the  
19 current situation. As you know, we had a locked-in  
20 period during the mid 80s. That figure, incidentally,  
21 was a 1991 figure.

22 I think all I can add to this is that we  
23 talked earlier and I believe it was with the MEA about  
24 life extension and we said at this time we have not got  
25 any firm plans for life extension. So the question as

1 to whether Bruce "A" would be life extended or not  
2 hasn't been decided yet, so obviously that would be a  
3 factor. If Bruce "A" was life extended then anything  
4 else would be additional to that. So we just haven't  
5 made that decision yet.

6 Q. Those are my next questions. That is  
7 fine.

8 The item I was referring to about system  
9 limitations appears on page 14-35 of Exhibit 3, and  
10 under the heading in column 3, Limited Generation at  
11 One Site, it reads:

12 No site should exceed 35 per cent of  
13 the total system generation requirements  
14 in its annual energy production.

15 Would I be right in saying that while  
16 BNPD is almost up to that now, what percentage three  
17 sites would contribute to the total net generation for  
18 the province would depend on the load within the  
19 province at that time?

20 A. Yes, that would certainly be one  
21 factor.

22 Q. This is a small point of  
23 clarification. If one were to change the number 4 in  
24 the phrase new 4 by 881 megawatt station, to a new 1 by  
25 881 megawatt station or a new 2 by 881 megawatt

1 station, would that make it more likely that a new  
2 station would be built during the planning period?

3 MS. HARVIE: I think that as well is a  
4 system planning question that these witnesses have no  
5 ability to deal with beyond speculating or giving  
6 evidence on how much additional capacity and energy  
7 could be obtained from a one unit 881 unit station.

8 MRS. MACKESY: I am content to leave  
9 that. Thank you.

10 Q. Now would you agree that this type of  
11 article might quiet some apprehension in the  
12 potentially directly affected public about the  
13 likelihood of a new transmission line?

14 MS. HARVIE: I don't know how these  
15 witnesses can give evidence about how the public would  
16 be --

17 THE CHAIRMAN: I agree. I don't think  
18 they should answer that question.

19 MRS. MACKESY: All right.

20 Q. And my next transmission-related  
21 question refers to the lead time chart in Exhibit 519,  
22 on page 78.

23 MR. PENN: A. Yes, I have that.

24 Q. Thank you. Now, on that chart, about  
25 five lines down from the top there is a line labelled

1 Environmental Assessment, and there has been some  
2 lengthy cross-examination about the validity of the  
3 length of time shown for that. And my question is:  
4 Does that length of time and section refer only to the  
5 environmental assessment process for the generating  
6 station, or does it also include some time allowance  
7 for an environmental assessment and hearing process for  
8 associated transmission?

9 A. No, as the title of the graph shows,  
10 it's specific for the Darlington site, as an example of  
11 the schedule of building a CANDU 6. The 18 months  
12 therefore recognizes the environmental knowledge of the  
13 Darlington site. It's the time to prepare the  
14 environmental assessment document, and the period of 24  
15 months following that on the same line is the period  
16 that we have assumed would be necessary for a project  
17 environmental assessment hearing allowing for time for  
18 the document to be reviewed by the ministries, assuming  
19 of course preconsultation had taken place with the  
20 ministries and the public, and other bodies, and that  
21 is as the chart shows would allow a total period of  
22 3-1/2 years from the start of the EA document to  
23 expected approval to proceed.

24 [12:42 p.m.]

25 Q. Now, you mentioned this is based on a

1       Darlington situation.

2                   A.   Yes.

3                   Q.   And I'm looking at page 14-37 again  
4       of Exhibit 3.   Perhaps you should get that out.

5                   A.   Yes.

6                   Q.   It's page 14-37.   Now under  
7       Darlington "B" near the top of the first column, the  
8       bottom point reads "could be incorporated on existing  
9       rights-of-way".   Going down to Bruce "C", the fourth  
10      point there reads "would require new transmission  
11      rights-of-way".

12                  So going back to page 78.   When you say  
13      that this chart refers to a Darlington situation, are  
14      you assuming that the right-of-way for the associated  
15      transmission has already been acquired?

16                  A.   Well, the chart on page 78 of Exhibit  
17      519 - and I think in my last answer I didn't complete  
18      it - it includes incorporation of this CANDU 6 into the  
19      existing transmission system at Darlington.

20                  Q.   Taking into account --

21                  A.   Incorporation, that's the short  
22      distance from the switch yard to the transmission  
23      corridor that runs along, runs across actually, Highway  
24      401 at Darlington.

25                  Q.   So then this is just a very short



1 connector line you are speaking of?

2 A. Yes, it is.

3 Q. I see. And this chart doesn't  
4 include any consideration of whether or not you would  
5 need transmission beyond that; am I correct?

6 A. Well, if it was sited at Darlington,  
7 we wouldn't need any more transmission. We would just  
8 need to incorporate it into the existing transmission.

9 If a future station were to be built in  
10 the North Channel area, for example, then, the  
11 incorporation distance would be considerably longer to  
12 the major transmission line, and its environmental  
13 assessment would include that incorporation as well.

14 Q. And that could involve a longer  
15 environmental assessment hearing time, environmental  
16 assessment process?

17 A. It may not. I can't answer that  
18 question. I don't know at this stage.

19 Q. Okay.

20 MR. JOHANSEN: A. Mrs. Mackesy, they  
21 would be considered as integral components of the  
22 overall project and would be assessed in parallel.

23 Q. What I am trying to get at is how  
24 this line regarding environmental assessment handles  
25 the situation where new transmission is needed. In

1       that case, would you extend that line any time  
2       distance?

3                   MR. PENN: A. Well, whenever you build a  
4       new generating system, whether it's coal-fired or  
5       oil-fired or gas-fired or hydroelectric or nuclear, you  
6       have to incorporate that new generating station with  
7       the transmission system.

8                   Now, if in fact there was a need to  
9       strengthen the transmission system, I'm not sure at  
10      this stage whether it would be subject to a separate  
11      hearing or not. It would depend, I would think, on the  
12      magnitude of the new system you were considering.

13                   But to my knowledge, we haven't in  
14      Exhibit 3 considered major transmission system  
15      additions with new nuclear plant for example.

16                   Q. You haven't?

17                   A. Not as far as I'm concerned. Or as I  
18      know.

19                   Q. Well, thinking of the North Channel  
20      and Bruce "C" which both require new transmission, I am  
21      not sure I understand what you are saying.

22                   A. They require incorporation. I don't  
23      know -- this is a question for people who have  
24      knowledge of the transmission system.

25                   Q. I am willing to leave that.

1 THE CHAIRMAN: If this is relevant at  
2 all, which I am not certain it is, it's not for this  
3 panel. It's for Panel 10.

4 MRS. MACKESY: I can understand that  
5 aspect. But I'm trying to find out whether the time  
6 period for the environmental assessment as listed on  
7 page 78 --

8 THE CHAIRMAN: I think the answer has  
9 been given that that time period was designed to  
10 incorporate any related transmission that might be  
11 involved. Now, obviously, when you get down a  
12 particular project, you are going to have to make  
13 adjustments one way or the other in the time period,  
14 but that was just put in as illustrative of the kind of  
15 time that's involved in putting a nuclear generation  
16 plant in-service. There are bound to be changes one  
17 way or the other in all the time frames there and it  
18 will depend very much on the specific situation.

19 MRS. MACKESY: Q. Could I just ask one  
20 general question then: Might the environmental  
21 assessment process be longer than you have illustrated  
22 it here on this chart because of transmission  
23 incorporation?

24 MR. PENN: A. Not necessarily because of  
25 transmission. But it might be longer. At the time we

1 determined this sort of period, we felt that that was  
2 reasonable.

3 Q. For Darlington --

4 A. A two-year period for having produced  
5 all the necessary documents to seek approval, we felt  
6 that two years was a reasonable period of time to reach  
7 a decision. Now, I can't speculate on whether it might  
8 be longer or shorter. That's just an assumption that  
9 we have made.

10 Q. Is that assessment based specifically  
11 on the Darlington situation or just a general  
12 composite?

13 A. That's for Darlington. If it was on  
14 a new site, I have indicated in previous testimony that  
15 the preparation of the environmental assessment  
16 document could take up to 30 months because there  
17 wouldn't be available one or two complete full years of  
18 seasons of environmental information about the site.  
19 That's the reason that is increased.

20 And secondly, the period of hearing the  
21 evidence at a public hearing may be longer than two  
22 years particularly if, for example, it was a light  
23 water reactor station such as an advanced light water  
24 reactor where people are less familiar with the issues  
25 and the engineering information.

1 Q. And if you need a new transmission  
2 route as opposed to an existing route, as is indicated  
3 for Darlington, could that also lengthen the  
4 environmental process.

5 THE CHAIRMAN: I think the answer is it  
6 might or might not. I think you have to accept that.

7 MRS. MACKESY: Q. Now, Mr. Penn, this  
8 refers to some testimony from you in Volume 131 at page  
9 23025 and this is at lines 14 to 19 on page 23025.

10 MR. PENN: A. I'm sorry, Mrs. Mackesy, I  
11 was trying to get the context of this evidence. You  
12 want me to look at line 13?

13 Q. At line 14 to 19.

14 A. Of page 23025?

15 Q. That's correct.

16 A. Thank you. Yes?

17 Q. Now, I will read that into the  
18 transcript and you are referring to:

19 "...single hearing would determine  
20 need as well as options, alternatives,  
21 and it would consider site-specific or  
22 project-specific information as well."

23 And you conclude "That's my assumption."

24 And then go on:

25 "Now obviously the decision of what it

1 shall cover is something for the future."

2 What I was going to ask you about was:

3 Is it your opinion that a site-specific hearing would  
4 include a discussion of need in the terms in which it's  
5 being addressed here?

6 THE CHAIRMAN: I don't think Mr. Penn can  
7 answer this question either. I am not sure anyone can  
8 answer it, but if anyone can it will be Panel 10.

9 MRS. MACKESY: Q. Now my next questions  
10 have to do with smaller nuclear developments or the  
11 lack of them.

12 And Mr. Penn again I would like you to  
13 refer to some remarks you made to the Coalition of  
14 Environmental Groups about a proposed CANDU 3  
15 development at Deep River and this is in transcript  
16 Volume 137 at page 24150.

17 MR. PENN: A. Yes, I have that page.

18 Q. Lines 8 to 14.

19 A. Yes.

20 Q. At page 24150, lines 8 to 14. I will  
21 read this into the transcript. And you are saying:

22 "I'm not exactly sure when I say this,  
23 but I happened to be with Mr. Franklin  
24 when we had a meeting with the Council of  
25 Deep River who were very interested in



1                   hosting a CANDU 3 in that area, and the  
2                   main reason for Mr. Franklin's view on  
3                   CANDU 3 was more related to its size on  
4                   the Ontario generating system than any  
5                   other reason."

6                   And my question arising out of that is  
7                   what did you mean when you said the main reason for Mr.  
8                   Franklin's view on CANDU 3 was more related to its size  
9                   on the generating system than any other reason?

10                  A. Well, I recall that the Council and  
11                  the Mayor together with their legal counsel visited  
12                  Hydro to encourage Hydro to take an interest in  
13                  building a single CANDU 3 nuclear station just west of  
14                  Deep River, actually a little upstream from the NDP  
15                  nuclear plant on the Ottawa River. And I don't know  
16                  whether I can say any more.

17                  The site and the flow of water at that  
18                  point on the Ottawa River is insufficient to cool -- in  
19                  fact, there was even doubt whether it was sufficient  
20                  for a CANDU 3. And at that time a CANDU 3, the output  
21                  to the capacity was just very small compared with the  
22                  total system need as shown in Exhibit 3.

23                  Q. So, the last part of your answer  
24                  would then be the explanation of the section I was  
25                  inquiring about: that the project was turned down

1 because of the relationship between the size of CANDU 3  
2 and the needs of the Ontario generating system?

3 A. Well, I can't add anything to what I  
4 have said there. I happened to be at this meeting  
5 because I had knowledge of the cooling water  
6 requirements and the nature of frazil ice on the Ottawa  
7 River and that was the reason I was there.

8 Q. Now, would you please turn to page 14  
9 of my second materials package and this is  
10 interrogatory 9.29.11. Can I have a number, please.

11 THE REGISTRAR: .168.

12 ---EXHIBIT NO. 520.168: Interrogatory No. 9.29.11.

13 MRS. MACKESY: Q. In this question I  
14 asked or I began it with the explanation:

15 "Exhibit No. 73 (Draft Demand/Supply  
16 Planning Strategy Review), page 12, lists  
17 an advantage of the CANDU 3, the single  
18 450-megawatt nuclear unit, which is not  
19 mentioned in Exhibit 3 on page 14-27 or  
20 on page 14-33, namely that of supplying  
21 major population centres distant from  
22 major supply facilities."

23 And I should correct an error. Page 12  
24 should read part C, page 12, from Exhibit 73. Part C  
25 in that exhibit is a listing entitled "Participant Key

1 Messages Related to the Draft Demand/Supply Planning  
2 Study" and page 12 summarizes the ideas contained in  
3 submissions by the Atomic Energy of Canada Limited. So  
4 this was a suggestion put forward by AECL.

5 And I asked why was that advantage not  
6 included in the set page on the pages of Exhibit 3  
7 which I referred to. Ontario Hydro's answer was:

8 "The CANDU 3 was excluded from further  
9 considerations in Exhibit 3 (Ontario  
10 Hydro's Demand/Supply Plan Report) on the  
11 basis that (1), it is not commercially  
12 proven and (2), it does not offer cost  
13 advantages, even if it were to perform  
14 reliably. Further discussion of its  
15 advantages and disadvantages were  
16 therefore immaterial."

17 And my question is: Does that answer  
18 still stand?

19 MR. PENN: A. Well, at the time that the  
20 draft Demand/Supply Planning Strategy was written and  
21 considered, which was in the period 1987/88, and of  
22 course when the Demand/Supply Plan, Exhibit 3, was  
23 written and submitted for approval, which was December  
24 1989, AECL had not completed very much engineering on  
25 CANDU 3 and so what was written in Exhibit 3 I think

1 was correct at the time. It is not commercially  
2 proven.

3 What we have today is a design which is  
4 now more than 80 or 85 per cent complete but still  
5 hasn't been built and operated anywhere. So I don't  
6 see any need to change that statement, one.

7 And two, it does not offer cost  
8 advantages. I think that my direct evidence clearly  
9 showed that a single CANDU 3 has a pretty high  
10 levelized unit energy cost compared with the other  
11 options and that you would have to build four of them  
12 in order to make them cost-effective with other  
13 options.

14 Q. So, then, going back to one of the  
15 benefits associated it, that is, of supplying major  
16 population centres distant from major supply  
17 facilities, this would involve a cost penalty if you  
18 were to use it in those situations, assuming it does  
19 become commercially proven at some point?

20 A. Yes, it would. And if you located a  
21 plant in a more remote area with low population, then  
22 it would be other reasons that you would do that for.  
23 You certainly wouldn't do it for cost reasons.

24 Q. Okay.

25 Are there any small electricity-producing

1 nuclear reactors in the 2, 10, 50 or 100 megawatt size?

2 [1:01 p.m.]

3 A. Do you mean in the world?

4 Q. Yes.

5 A. I imagine there are still some plants  
6 less than 100 megawatts operating in the world. I  
7 can't call them to mind. I doubt very much whether  
8 they are economic at that size.

9 Q. This may be another question that you  
10 won't be able to answer. In your opinion are either  
11 small or large nuclear new generating units socially  
12 acceptable in large cities?

13 A. I'm sorry, I didn't follow that  
14 question.

15 Q. In your opinion, are either small  
16 other large new nuclear generating units socially  
17 acceptable developments in large cities?

18 A. Well, you are asking my opinion and  
19 my opinion would be that locating significant  
20 industrial facilities in the centre of large cities is  
21 not particularly desirable.

22 Q. Has Ontario Hydro tried to interest  
23 anyone in developing commercial nuclear generation  
24 units for filling local community power demands, not  
25 necessarily in remote areas, what are called remote

1 areas, but in heavily populated areas?

2 A. Well, I think maybe Mr. Snelson is  
3 the best person on Panel 10 to comment on that.

4 When you are about talking very small  
5 reactors, the only ones that I am familiar with are the  
6 Slowpoke 5 megawatt and 10 megawatt plants that were  
7 designed for remote operation in Northern Canada, far  
8 Northern Canada.

9 Q. And when you spoke of the 450  
10 megawatt reactor possibly being used in remote  
11 locations, you hadn't thought of use that either in the  
12 more heavily populated areas for filling low community  
13 demands?

14 A. Well, I don't think I have got a  
15 position on it. Again, it's a planning matter.

16 I have never personally considered that  
17 question.

18 Q. My final question before lunch.  
19 Because of the way nuclear generation is sited, would  
20 you agree that it is vitally dependent upon bulk  
21 transmission to carry the electricity to where it is  
22 needed?

23 A. Any generating station must be able  
24 to supply load centres via transmission lines, either  
25 underground or above ground.



1 Q. In the case of nuclear where you have  
2 a few large highly central concentrated developments,  
3 they are vitally dependent on the bulk transmission,  
4 would that be correct?

5 A. Well, just the same as our Nanticoke  
6 station which is eight 500 megawatt coal-fired units,  
7 it's the same issue.

8 Q. So it's a factor of the size of  
9 units?

10 A. Well, irrespective of size, you still  
11 have got to transmit the energy to my home and your  
12 home and industry and wherever. You can't get away  
13 from it.

14 MRS. MACKESY: I think I can go on with  
15 that in Panel 10.

16 This would be a good time to break now,  
17 Mr. Chairman.

18 THE CHAIRMAN: How much longer do you  
19 think you are going to be?

20 MRS. MACKESY: I am going to try to cut  
21 it down to about an hour-and-a-half if possible.

22 THE CHAIRMAN: All right. We are  
23 adjourned until 2:30.

24 MS. HARVIE: Mr. Chairman, just before we  
25 adjourn, you might think about the possibility over

1 lunch of sitting later tonight in light of the fact  
2 that Mrs. Mackesy is going to be a little longer than I  
3 expected at any rate. I am just afraid that we are  
4 getting very tight given that we have several parties  
5 after her.

6 THE CHAIRMAN: All right. Thank you.

7 THE REGISTRAR: Please come to order.

8 This hearing will adjourn until 2:30.

9 ---Luncheon recess at 1:07 p.m.

10 ---On resuming at 2:30 p.m.

11 THE REGISTRAR: Please come to order.

12 This hearing is again in session. Please be seated.

13 THE CHAIRMAN: Mrs. Mackesy?

14 MRS. MACKESY: Thank you.

15 Q. Mr. Johansen, do you have a reply as  
16 to whether Inverhuron Park is entirely within the five  
17 mile zone around the heavy water plants?

18 MR. JOHANSEN: A. The park certainly is  
19 within a five mile radius around the heavy water plant.

20 The description of that zone perhaps  
21 should be qualified slightly. I referred to it as a  
22 five mile zone within which a population and other land  
23 use development should be somehow controlled.

24 In its initial version of that siting  
25 guide, the AECB, as I recall, did refer to the five

1 mile radius quite explicitly. That was somewhat  
2 generalized in the final version that was issued  
3 sometime later.

4 I believe the current version of it  
5 restricts permanent residence within one mile of a  
6 heavy water plant, and beyond one mile out to some  
7 distance, X, which depends on the particular design of  
8 heavy water production facility, it could be up to five  
9 miles for plants of the Bruce design, but within that  
10 distance there would be other provisions for alerting  
11 the population in the event of a significant release.

12 But the simple answer is, yes, it is  
13 within the five mile radius.

14 Q. Thank you.

15 Now, Mr. King, I think several of my next  
16 questions are for you.

17 First, would you please turn to the last  
18 page of my second package of materials. This is one  
19 page taken from a 1972 Ontario Department of Lands and  
20 Forests Brief to the Task Force on Generation Station  
21 Siting, and the cover page of that report is shown on  
22 page 39, one page ahead of the last page of the  
23 report -- of my materials.

24 The part of page 40 that I want to draw  
25 to your attention is the last full sentence of the

1 first paragraph down towards the bottom of the page,  
2 the sentence begins: It should be borne in mind...  
3 and I will read that sentence into the transcript.

4 It should be borne in mind that safety  
5 limits, acceptable hazardous and similar  
6 words are not agreed upon except as laws  
7 of society, and have biomedical meaning  
8 only insofar as the interpretation of  
9 research on which the limits are based  
10 are valid.

11 And my question is: Do you accept that  
12 statement as accurate?

13 MR. KING: A. Is this the final report  
14 of this or is this somebody's submission?

15 THE CHAIRMAN: It's a submission made  
16 back in 1972, but I suppose it is taken out of context,  
17 but the statement is self-contained.

18 MR. KING: If could you give me a minute  
19 to look at it again.

20 MRS. MACKESY: Yes. Sure.

21 THE CHAIRMAN: I am not sure it's really  
22 within you are area. It's more in Dr. Whillans' area,  
23 I would expect.

24 MRS. MACKESY: I'm sorry.

25 MR. KING: I could only comment that the

1 terms that are in parenthesis here, safety limits and  
2 acceptable hazards, have to be defined before people  
3 can have a discussion using these terms.

4 Where it goes on and it says, except by  
5 laws of society, I am not sure what they are referring  
6 to at all. I can't help you at all. Maybe Dr.

7 Whillans can?

8 Q. Okay. Pass it back to Dr. Whillans.  
9 Thank you.

10 DR. WHILLANS: A. I am not sure I can  
11 help you very much more. I was very happy with what  
12 Mr. King said, these are terms which have a specific  
13 meaning only when they are defined and I guess that is  
14 what is referred to when they talk about being agreed  
15 upon except as laws of society.

16 Perhaps could you restate your question.

17 Q. When you use a term such as emission  
18 limits or something is acceptable, are you using it in  
19 a similarly limited way?

20 A. I think when you say an emission  
21 limit, that's more specific if we talking  
22 specifically --

23 Q. When you say that is acceptable as  
24 far as a siting criteria.

25 A. Well, I guess there are different

1 levels of acceptability. One level is certainly that  
2 it meets the regulated law or stays within the  
3 regulation, and then of course there is another level  
4 of acceptability which could refer to public  
5 acceptability and they may or may not be the same  
6 thing.

7 Q. So when you speak of staying within  
8 the regulations, that would perhaps apply to the laws  
9 of society as is listed in this statement?

10 A. Well, that's why I thought laws of  
11 society may have been mentioned in this statement.

12 Q. Now, going on to the term biomedical  
13 meaning, can you say anything about that? Biomedical  
14 meaning --

15 A. Well, it's certainly true that in  
16 order to place some form of health risk level on a  
17 particular limit, then that depends on the research as  
18 they call it, and it's only true insofar as that  
19 research interpretation is valid. That's certainly  
20 true, yes.

21 Q. Is this a statement that is generally  
22 applicable to any safety consideration, not just to  
23 nuclear generation siting --

24 A. The statement that...?

25 Q. Is generally applicable to any



1 discussion of safety, not just to siting of nuclear.

2 A. I guess I am trying to clarify. I  
3 think we are talking about two things here, the idea of  
4 acceptable in a legal sense or in another sense, and  
5 then the question of whether the interpretation depends  
6 on the validity of the research. You are taking that  
7 as one statement?

8 Q. Yes.

9 THE CHAIRMAN: It's not a very  
10 happily-worded sentence, but does it not mean or could  
11 it not mean that these words that are in quotation  
12 marks have to be considered in the context in which  
13 they are used. Would that be what the author is trying  
14 to say?

15 DR. WHILLANS: I think that's a fair way  
16 to say it, yes.

17 MRS. MACKESY: Thank you.

18 Q. I suppose my last question based on  
19 that is that while the term safety limit and acceptable  
20 hazards are used, that doesn't mean that they are  
21 absolutely safe, because there may be some error in the  
22 analysis that went into the research on which they are  
23 based?

24 DR. WHILLANS: A. There are probably  
25 many reasons why you might not agree that something is

1 absolutely safe. In fact, I guess given that we are  
2 aren't certain about anything, nothing is absolutely  
3 safe.

4 I don't know whether that answers your  
5 question.

6 Q. I think I will leave it at that,  
7 thank you.

8 Now, would you please turn to Exhibit  
9 585. I am not sure whether you will have it as a  
10 separate exhibit or as part of Exhibit 577, which was  
11 among the Coalition of Environmental Groups' material.

12 THE CHAIRMAN: I have got it.

13 MRS. MACKESY: Q. This is described on  
14 the first page of Exhibit 585 as a Ministry of Energy  
15 Briefing Note from the Policy Development and  
16 Coordination Division within the Ministry of Energy,  
17 and it's entitled, Major Nuclear Generating Station  
18 Outages. And further on, on page 9 is the date of  
19 February 26, 1991.

20 Now, Mr. King, I think this is for you,  
21 so perhaps you can actually look at it.

22 Would you please turn to page 4 of the  
23 exhibit, and halfway down the page under the heading  
24 Pressure Tube Inspection and Replacements, the second  
25 and third paragraphs speak to problems with the

1 pressure tubes at Pickering and at Bruce. I will read  
2 the two paragraphs into the transcript.

3 The pressure tubes are being inspected  
4 to determine if the tubes have started to  
5 form blisters. These blisters can with  
6 time begin to crack and eventually cause  
7 the entire pressure tube to break and  
8 such a break occurred at Pickering 2 in  
9 1983. The 1983 incident caused little  
10 damage to the fuel and no significant  
11 release of radioactivity from the fuel  
12 bundle. Recent laboratory experiments  
13 have suggested however that an accident  
14 at the Bruce station could have more  
15 serious safety consequences and this has  
16 an increased the concern of both Ontario  
17 Hydro and the Atomic Energy Control  
18 Board.

19 My first question is: Do you agree with  
20 that last statement, or with the second paragraph about  
21 the situation at Bruce and there being cause for  
22 concern to both Ontario Hydro and the AECB?

23 MR. KING: A. The third bullet, the  
24 second sentence, you are asking me if I agree with  
25 that?

1 Q. Yes.

2 A. I am afraid I am not sure exactly  
3 what they are referring -- does this report have an  
4 author?

5 THE CHAIRMAN: It's Mr. Fraser of the  
6 energy department. He was preparing submissions for  
7 some other department.

8 MR. KING: Okay. On page 9 it has it  
9 prepared by Peter Fraser.

10 I am afraid I am not exactly sure what --  
11 we are doing experiments regularly...

12 MRS. MACKESY: Q. Would you be able to  
13 check into that?

14 MR. KING: A. Well, without talking to  
15 Mr. Fraser -- I have to know what Mr. Fraser was  
16 talking about.

17 MS. HARVIE: I think, Mr. Chairman, what  
18 the witness is saying is that if these studies were not  
19 carried out by Ontario Hydro, and it is not clear from  
20 reading this that they were, that we wouldn't  
21 necessarily have knowledge of the experiments.

22 THE CHAIRMAN: Well, I guess the best you  
23 can say is you don't know what Mr. Fraser is referring  
24 to; is that right?

25 MR. KING: That's, I guess, the bottom

1 line.

2 I am saying we are doing various types of  
3 experiments all the time.

4 THE CHAIRMAN: Let me ask you this, Mr.  
5 King. If recent lab experiments did suggest an  
6 accident at the Bruce station could have more serious  
7 safety consequences and this has increased the concern  
8 of both Ontario Hydro and the Atomic Energy Control  
9 Board, would you know about that?

10 MR. KING: I may well know about it, not  
11 from my direct involvement -- I am not involved in  
12 conducting or analyzing these particular experiments.

13 The issue that causes me a bit of problem  
14 why the accident at the Bruce station could have any  
15 more serious consequences. Generally our experiments  
16 regarding pressure tube failures are generic to all the  
17 reactors, so I just can't think of anything which is  
18 particular to the Bruce station.

19 THE CHAIRMAN: Okay.

20 MRS. MACKESY: Q. That was of the nub of  
21 my next question.

22 THE CHAIRMAN: That's the answer that you  
23 have to...

24 MRS. MACKESY: That's the answer, okay.

25 Q. Now my next questions have to do the

1 childhood leukaemia studies, and, Dr. Whillans, I  
2 suspect that's your area.  
3 [2:46 p.m.]

4 And my first question pertains to  
5 transcript Volume 133, page 23336. And it's the first  
6 full paragraph starting about line 6. I am breaking  
7 into the middle of a sentence. I better start at the  
8 beginning of a sentence:

9 "As a matter of fact, yes, there is a  
10 follow-up study which should be published  
11 any month now, which basically took the  
12 cases in this region, the Pickering  
13 region, that were identified in this  
14 study, and matched them with controls.  
15 This is another epidemiological method  
16 where you compare cases and controls and  
17 look for risk factors which might be  
18 different. And the Cancer Foundation  
19 sponsored by the AECSB is doing such a  
20 study with these children, looking  
21 particularly at whether or not the  
22 fathers of the children are radiation  
23 workers. This again is because a similar  
24 kind of study had been carried out around  
25 Sellafield. And Ontario Hydro has



1                   cooperated to the extent of providing  
2                   dose records, detailed dose records."

3                   Now I gather this is a follow-up study to  
4                   the 1989 and 1991 leukaemia studies carried out by the  
5                   Ontario Cancer Foundation.

6                   At line 6 and 7, you mentioned the study  
7                   taking cases from the Pickering area. And my question  
8                   is: Did this new study which is to be published  
9                   shortly take any cases from other areas than Pickering?

10                  DR. WHILLANS: A. No, I believe the  
11                  study took all of the cases that had been identified.  
12                  So here I was referring to the Pickering area but I  
13                  think it took all of the cases. I haven't seen a final  
14                  report yet so I can't tell you exactly what was done.  
15                  My understanding was that it was taking all of those  
16                  cases.

17                  Q. So it would not only be around the  
18                  nuclear generating facilities but around the research  
19                  facilities.

20                  A. There were five facilities in the  
21                  original studies including the generating facilities,  
22                  Pickering, Bruce, and the research facility at Chalk  
23                  River, and the Port Hope area and the Elliot Lake area.  
24                  And my understanding was that they had planned to look  
25                  at all those regions in this final phase as well.

1 Q. Now, would you please turn to pages 2  
2 and 3 of my package No. 3, please.

3 A. Sorry what page was that again?

4 Q. 2 and 3.

5 A. 2 and 3?

6 Q. Yes.

7 Page 2 is a photocopy of page 11 from the  
8 first phase of the childhood leukaemia studies around  
9 the Canadian nuclear facilities; and page 3 is a copy  
10 of page 18 of Phase 2 of the study.

11 I am going to read sections from each  
12 page into the transcript. Page 11, the Phase 1 study,  
13 will already have been entered under Exhibit No. 520.16  
14 while the Phase 2 study has been entered under Exhibit  
15 No. 520.17.

16 Now, to read from the Phase 1 study dated  
17 May 1989, I am beginning about halfway through the  
18 paragraph at the top of page 11. And it reads:

19 "The relative risk estimates obtained  
20 for Bruce County were higher than for  
21 Durham Regional Municipality, with values  
22 that ranged from 0.9 (where observed  
23 equals 2 and expected equals 2.3) to 3.5  
24 (where observed equals 2 and expected  
25 equals 0.6). It must be noted that for

1 both the Bruce County and 'nearby' area  
2 analyses, the estimates were based on a  
3 very small number of events (less than  
4 five) and an even smaller number of  
5 expected events, which is indicated by  
6 the width of the confidence levels.

7 A pooled estimate of the 'nearby'  
8 areas around either of the generating  
9 stations was 1.46 (where observed equals  
10 19 and expected equals 13) for the  
11 mortality analysis by residence at time  
12 of birth. In general, these results of  
13 exploratory studies of leukaemia risk  
14 around nuclear power generating stations  
15 are suggestive of a slight increased  
16 relative risk that well may be due to  
17 chance. Additional research is necessary  
18 to examine this further."

19 Going on to the next page from the Phase  
20 2 study, this is the second full paragraph on the top  
21 of the page:

22 "The relative risk estimates obtained  
23 for Bruce County were higher than for  
24 Durham Regional Municipality, with values  
25 that ranged from 0.91 (where observed

1 equals 6 and expected equals 6.6) to 2.78  
2 (where observed equals 3 and expected  
3 equals 1.1). It must be noted that for  
4 both the Bruce County and 'nearby' area  
5 analyses, the estimates were based on a  
6 very small number of observed events,  
7 ranging from 3 to 9, and an even smaller  
8 number of expected events which gave rise  
9 to wide confidence intervals."

10 Now, I realize there are a number of  
11 questions about the methodology of these studies, so my  
12 questions are going to be quite general.

13 Would you agree that the 1989 and 1991  
14 studies show relatively higher incidence rates for the  
15 Bruce region over the Pickering region?

16 A. Well, certainly the central estimate  
17 for the relative risk is higher for Bruce than for the  
18 Pickering area. But as the sections you have read  
19 point out, the confidence limit, the range in which the  
20 real number is likely to lie is very, very wide,  
21 especially at Bruce. So I think statistically you  
22 wouldn't really say they are different. But certainly  
23 the central estimate is a bigger number, yes.

24 Q. Is this wide confidence level the  
25 result of there being a smaller population from which

1 to draw the original figures?

2 A. That's the main reason, yes.

3 A. One measure of that -- you notice in  
4 the paragraph that you read on page 18, they talk about  
5 the risk estimates for Bruce County and then they say  
6 .91 to 2.78. The reason there is a range of numbers  
7 even for this central estimate is because they looked  
8 at a number of different ways of analyzing the data:  
9 by residents at death, by residents at birth, looking  
10 at the population in the county; or in another area  
11 which they called nearby, and so forth.

12 And I guess one thing that comes from a  
13 comparison even within one region like Bruce County  
14 where you get numbers that range from .9 to 2.78, it  
15 gives you an idea that any one of those numbers, if you  
16 used it alone, might give you an incorrect picture of  
17 what the real risk was.

18 Q. Now, I believe you said there is move  
19 more difficult -- maybe I'm paraphrasing this. It's  
20 more difficult to get statistically accepted results  
21 from a study of a small population.

22 A. That's true. The power to  
23 differentiate a real risk from a non-risk is much less  
24 if you have only a few cases to work with.

25 Q. Would that or could that mean that

1 the existence of real problems in an area of small  
2 population such as the Bruce could be masked by these  
3 statistical difficulties that arise when studies are  
4 done in such an area?

5 A. I think generally speaking that's  
6 true. If you have a very sparse population so that  
7 even if there were a significant risk you would have  
8 few occurrences of the result of the risk. You might  
9 not see it. That's always true and it would be true of  
10 a population such as around Bruce compared with, say,  
11 around Pickering.

12 And that's why in these studies people  
13 tend to look at a number of different areas so that  
14 they can look for such features as consistency. Unless  
15 you think that there is something unique say about  
16 Bruce, you would expect to see the same kind of effect  
17 at Pickering or some other area as you do at Bruce.

18 And that's true internationally as well.  
19 This study was done to test whether or not something  
20 that had been seen in the U.K. applied here as well.  
21 So you are looking for consistency.

22 Q. If you have some unique or larger  
23 features in a development such as at the Bruce Nuclear  
24 Power Development, and you do studies to try to find  
25 out whether effects from that are having an impact on



1 the surrounding population, and the population is  
2 small, will that impact necessarily be picked up if you  
3 study that group as part of a larger group which  
4 doesn't have the same types of facilities exerting an  
5 effect.

6 A. Each of these regions was studied  
7 separately and there was some pooling to get a general  
8 estimate. But as you say, Bruce was given its own  
9 numbers compared to the population of Ontario as a  
10 whole, and the number came out to be, depending on  
11 exactly how it was done, .91 to 2.78. So each region,  
12 including Bruce, was done separately.

13 And then if there had been some startling  
14 difference, that would have been an indication that  
15 there was something different about the Bruce area.  
16 And I guess the statistician would say, even though the  
17 number might have been 2.78 or even something  
18 higher, within the data that was available for the  
19 Bruce County, there wasn't enough information to let  
20 you say that there was something startlingly different;  
21 and equally you wouldn't say that there is absolutely  
22 no possibility that there an increased risk at Bruce  
23 because again you just don't have the precision in the  
24 estimate to say that it is, say, less than one.

25 Q. And the small size of the population

1 from which you are drawing the information makes it  
2 more difficult to establish whether there was  
3 something?

4 A. Thinking again about the Bruce area  
5 specifically--

6 Q. Yes.

7 A. --because the population is fairly  
8 small? It does make it more difficult, yes.

9 Q. Thank you.

10 Now, I'm moving now questions on risk  
11 assessment. So I suppose, Mr. King, these are going to  
12 be for you. Is risk assessment a type of site  
13 assessment?

14 MR. KING: A. No, generally not.

15 Q. The reason I ask that is because I  
16 was looking through some material in the Darlington  
17 safety report. Now would you turn to pages 24 and 25  
18 of the second package of materials, please.

19 Now, as I understand the risk assessment,  
20 it takes into account both probability and  
21 consequences; is that correct?

22 A. Yes.

23 Q. Now, looking at page 25 of my  
24 package, chapter 1 of the Darlington safety report,  
25 which is identified as site evaluation on the preceding

1 page, has section 2 headed "Factors affecting a  
2 release". And there are two sections or three sections  
3 to that actually. But the first section, 2.1, reads  
4 "Factors affecting the probability of a release"; the  
5 second section, 2.2, reads "Factors affecting the  
6 consequences of a release"; and then factor 2.3 goes on  
7 to the management of waste materials.

8 And because those two terms were used,  
9 probability of a release and consequences of a release,  
10 under site evaluation, I asked the question whether  
11 risk assessment is a type of site assessment.

12 THE CHAIRMAN: First of all, they are not  
13 under the site evaluation section; they are under  
14 section 2 dealing with factors affecting a release.

15 MRS. MACKESY: Yes, which is under site  
16 evaluation --

17 THE CHAIRMAN: Site evaluation is the  
18 previous section, which does have, I notice, 1.2,  
19 Safety Philosophy in it.

20 MRS. MACKESY: That may be an error in my  
21 interpretation. I assumed that factors affecting a  
22 release was a subsection of site evaluation, but I may  
23 be incorrect about that.

24 MR. KING: I think I can clarify it, Mr.  
25 Chairman.

1 THE CHAIRMAN: Yes. Perhaps she may be  
2 right.

3 MR. KING: Yes.

4 Volume 1 of the safety report is called,  
5 the title of the volume is "Site Evaluation". And why  
6 in this page 25, 2.1 and section 2.2 they are talking  
7 about the site factors which could affect the  
8 probability of a release or the site factors which  
9 could affect the consequences of a release.

10 Now, those are only very small factors  
11 they are not the major factors which affect the  
12 probability or consequences of the release. So, for  
13 example, I'm not sure whether you have dug out those  
14 exact pages in the site evaluation.

15 MRS. MACKESY: Q. I have looked through  
16 them, yes.

17 MR. KING: A. But they will be talking  
18 about the factors that could cause an accident which  
19 are site related, nearby industrial activity, seismic  
20 activity, et cetera.

21 Q. Yes, if I could just direct you to  
22 pages 6 and 7 of the third package of materials. This  
23 is from a similar section on the Bruce generating  
24 station "A" safety report. And under chapter 1,  
25 section 2, contents, factors affecting a release, there

1 is a more detailed listing. I couldn't find that type  
2 of table of contents in the Darlington report or I  
3 would have included it instead. But, yes, as you say  
4 you were --

5 A. There are very similar subsections in  
6 the Darlington safety report.

7 Q. So, let me try and get this straight.  
8 I assumed that these factors were considered as part of  
9 the site evaluation; is that correct?

10 A. They are factors involved in  
11 characterizing the site. These are sections in the  
12 safety report so they are factors which characterize  
13 the site as it may be, as it may impact the safety  
14 assessment for the station.

15 Q. And they are limited to that  
16 particular use in this...

17 A. Yes. Now, I believe in the  
18 Darlington safety report case, the source of the  
19 material for that section of the safety report would  
20 have come from the work done or primarily done from the  
21 work done in the site evaluation, the environmental  
22 assessment that Mr. Johansen has talked about before,  
23 which was done very early in the mid 70s at the  
24 Darlington site.

25 Q. Thank you.

1 Now, if someone were to say to you if  
2 these plants are safe in the country, they are safe in  
3 the city, what would your response be?

4 THE CHAIRMAN: I'm sorry, I didn't hear  
5 that. If these plants are....

6 MRS. MACKESY: Q. If these plants are  
7 safe in the country, they are safe in the city, what  
8 would the panel's response be?

9 MR. KING: A. From the regulatory body  
10 point of view for the accident dose limits, there are  
11 two dose limits: one dealing with individuals and  
12 there is also a population dose limit. With respect to  
13 the individual dose limit, it doesn't matter where the  
14 plant is sited. You would get the same result because  
15 if there is nobody standing on the boundary you assume  
16 somebody is standing on the boundary.

17 With respect to the population dose  
18 limit, the larger the population in the nearby  
19 vicinity, the larger the dose predicted would be and  
20 then you would have to compare that to the limit. It  
21 would be more difficult to meet that part of the dose  
22 limit, population dose limit, in a large built-up area.

23 But then you have to look at the  
24 characteristics of the plant design and the local site  
25 factors to see whether it's the population dose limit



1 or the individual dose limit which is limiting.

2 Q. Does risk assessment tie into those  
3 considerations?

4 A. Maybe I should clarify. Risk  
5 assessment can be used as a very general term or it can  
6 be used as very specific term. I am assuming you are  
7 using it as a very specific term in particular because  
8 my job in Hydro is to be head of the risk assessment  
9 section at Ontario Hydro and we produce large risk  
10 assessments like one of the Darlington probabilistic  
11 safety evaluation.

12 [3:07 p.m.]

13 So, when you use the word "risk  
14 assessment", I am thinking you are talking about that  
15 sort of risk assessment and not the very general use of  
16 the term.

17 In the safety report, and that is the  
18 document we might submit to show that the regulatory  
19 limits that I explained in my direct evidence, the  
20 single dual failure limits or the AECB 6 limits, we  
21 wouldn't call those risk-based limits. We would call  
22 those deterministic limits, even though there has been  
23 a consideration of probability in setting the  
24 consequence of levels for the different categories of  
25 accident.

1                   Q. Now, if you were to use the term in a  
2                   very general way, could that then be used to justify  
3                   placing facilities in country areas and sparsely  
4                   populated areas rather than in more heavily populated  
5                   areas?

6                   A. There is no doubt that a prediction  
7                   of population dose under given accident conditions  
8                   would be larger in a built-up area. Whether you would  
9                   still meet a regulatory limit, you would have to do  
10                  your analysis, and given the limited hand then make  
11                  that comparison. But if you are just looking at a  
12                  direction, a trend, it would be more difficult in a  
13                  built-up area.

14                 Q. Thank you. Now, my next questions  
15                 have to do with the Chernobyl accident. To begin with  
16                 I would like to turn to Exhibit 507, page 5-19.  
17                 Looking at the second paragraph, the second sentence  
18                 beginning with the word "however" in the third line:

19                         However, the future risk of severe  
20                         accidents could only be predicted using  
21                         the consequences is of Chernobyl and its  
22                         frequency of occurrence so as long as  
23                         Chernobyl is representative of reactors  
24                         and the siting of concern.

25                         My first question is: What is the

1 connection between the siting of Chernobyl and the risk  
2 of severe nuclear accidents?

3 A. Well, I am assuming they are talking  
4 about not an individual risk but a collective risk to  
5 the population in that sentence.

6 Q. So that is a more general form of  
7 risk, would I be correct?

8 A. No. When you are referring to risk,  
9 you have to say the risk of what. Is it the risk to an  
10 individual or the risk to a population.

11 I assume in this sentence they are  
12 talking about a risk to the population because it  
13 would, as we have discussed earlier, really the siting  
14 has little to do with the individual risk.

15 Siting has somewhat of a concern when you  
16 are dealing with dispersion, but it would be a minor,  
17 generally a minor concern, assuming that they had  
18 exclusion radiuses of about the same distance.

19 Q. What was there about the siting of  
20 Chernobyl that would cause that to be commented upon?

21 A. Well, I assume they are talking about  
22 a population, and they are just saying given that you  
23 are talking about a population risk, that you could  
24 only use the consequences of Chernobyl as  
25 representative if the siting situation was similar to

1 Chernobyl and if the reactor was similar to Chernobyl.

2 I think that's all they are saying there.

3 Q. There has been a lot of evidence on  
4 how the reactors were different or similar.

5 How does the siting of Chernobyl compare  
6 to Ontario Hydro's plant sitings?

7 A. I am afraid I couldn't quote  
8 population densities. I assume it's less, less than  
9 some of our reactors and perhaps more than others.

10 Q. Thank you. Now, I would like to ask  
11 about one section of the report on Chernobyl entitled:  
12 International Chernobyl Project: An Overview. This is  
13 from Exhibit 560. I am looking at page 40.

14 THE CHAIRMAN: I'm sorry, what is Exhibit  
15 560?

16 MRS. MACKESY: Exhibit 560 is entitled  
17 the International Chernobyl Project: An Overview,  
18 Assessment of Radiological Consequences and Evaluation  
19 of Protective Measures.

20 THE CHAIRMAN: It's in the AECL materials  
21 behind tab 12.

22 MRS. MACKESY: Thank you.

23 Q. I am looking at page 40. Now, on the  
24 preceding page this section is headed Food  
25 Restrictions, that's on page 39, and turning over page

1 39 to 40, to the last section of that material, at the  
2 bottom of the page, the first column, three lines from  
3 the bottom it begins:

4 A range of counter-measures has been  
5 developed and taken with the aim of  
6 permitting the production of food with  
7 contamination below maximum permissible  
8 levels. Some of these measures have had  
9 the secondary benefit for agricultural  
10 workers of reducing the external dose  
11 from deposited contamination and the  
12 inhalation of resuspended radioactive  
13 materials.

14 Now, is this part saying, in part at  
15 least, that people in the contaminated area could clean  
16 up there radiation in their environment by eating it  
17 and having no harmful effects?

18 DR. WHILLANS: A. I haven't read this  
19 part in the detail recently, but I doubt if that's what  
20 it meant.

21 As you were reading it I was thinking  
22 perhaps it meant by turning the soil they have removed  
23 some of the activity from the surface.

24 Q. I see. The way I took it, and you  
25 can comment on this, is that they would grow the food

1 produced in the soil, either the vegetables directly or  
2 through animals taking up the material, and then the  
3 radioactivity would move through the food chain into  
4 the human population, but that this would do less harm  
5 than if the radioactivity were left undisturbed on the  
6 ground and they walked around in their daily existence  
7 in it.

8 A. I think mainly we are talking caesium  
9 137, which is long-lived and will persist on the  
10 surface unless something happens to it. It does wash  
11 away. It's fairly soluble.

12 In general I would think you wouldn't  
13 gain anything by having people ingest it as part of the  
14 counter measure. And as I said, I can only think as  
15 you read it that perhaps they are talking about getting  
16 it off the surface where it's available for  
17 resuspension and into the soil where it can be washed  
18 away.

19 Q. I see, okay. Thank you.

20 MR. KING: A. I believe one of the  
21 counter measures that they were considering was what  
22 was referred to as deep ploughing.

23 Q. I'm sorry?

24 A. Deep ploughing, which is consistent  
25 with what Dr. Whillans referred to.



1 Q. Can anyone on the panel tell me how  
2 far out from Chernobyl the food restrictions would have  
3 applied or did this vary from point on the compass to  
4 point on the compass?

5 DR. WHILLANS: A. I can't tell you  
6 offhand, but certainly I think in this volume there is  
7 an estimate. We could look through it, if you like.

8 Q. No, I can follow up on that myself.  
9 Were there restrictions placed on food  
10 produced outside of the republics of the former USSR?

11 A. Perhaps Mr. Johansen would like to  
12 comment, but I think even in England there were  
13 restrictions on some kinds of food. I'm not sure of  
14 the details, but sheep. I believe that's the case.

15 Do you have anything to add?

16 MR. JOHANSEN: A. I have only got  
17 anecdotal information picked up through the media, so I  
18 don't think it's too reliable.

19 DR. WHILLANS: A. I think it also true,  
20 for example, in Northern Europe, the native populations  
21 that live on reindeer were restricted and this had a  
22 big impact on them.

23 Q. All right. Going on. I would like  
24 to turn to page 33 and following in my second package  
25 of materials. This is an article on soil ingestion

1 from Health Physics of 1984. The article is entitled:  
2 Soil Ingestion by Cattle: A Neglected Pathway, and the  
3 authors are listed on page 36 of my package as Reto  
4 Zach and Keith R. Mayoh. I am not sure if I am  
5 pronouncing those correctly, of the Environmental  
6 Research Branch of the Atomic Energy of Canada Limited,  
7 at Whiteshell Nuclear Establishment, Pinawa, Manitoba.

8 Now, would you please turn to page 34 of  
9 my package, the second paragraph from the top in the  
10 first column, and I will read that into the record:

11 The significance of soil ingestion has  
12 already been recognized in the cases of  
13 chemical pollutants and of radionuclide  
14 ingestion by range cattle and mule deer.  
15 In this study we show that that soil  
16 ingestion by herbivores, such as dairy  
17 and beef cattle, can be a more important  
18 exposure pathway than ingestion of food  
19 or forage contaminated by root uptake.  
20 Consequently, the soil ingestion pathway  
21 must be added to the food chain models to  
22 ensure realistic and conservative dose  
23 estimates.

24 To whom should I address questions on  
25 this article?

1 THE CHAIRMAN: What is your question?

2 MRS. MACKESY: Q. Does the panel agree  
3 with the last sentence that I read, consequently the  
4 soil ingestion pathway must be added to food chain  
5 model to ensure realistic and conservative dose  
6 estimates?

7 MR. JOHANSEN: A. Perhaps I could start  
8 at least and I invite my colleagues to add a comment if  
9 they feel I haven't gone far enough or perhaps gone  
10 astray.

11 But I happen to know Dr. Zach, and  
12 although I am not sure that I have read this particular  
13 article, I am certainly familiar with his view that  
14 this pathway is one that should not be ignored.

15 I can confirm that in fact this pathway  
16 has been incorporated in the assessment model, food  
17 chain assessment model, used in the environmental and  
18 safety assessment of the used fuel disposal concept,  
19 which he is involved in, and it has similarly been  
20 incorporated in the environmental and safety assessment  
21 model that Ontario Hydro is using for its contribution  
22 to that disposal concept assessment covering the  
23 so-called preclosure period.

24 And there has been discussion amongst Dr.  
25 Zach and Ontario Hydro staff over the years about

1 developments of the food chain model for various other  
2 purposes, and I assume that some reconciliation or  
3 adjustment, appropriate adjustment, has been made. I  
4 can't confirm exactly what adjustment has been made,  
5 but I certainly can confirm that there has been  
6 considerable discussion of that subject over the years.

7 Q. So you are not sure that it has been  
8 included yet in the food chain model?

9 A. For reactor safety analysis purposes?

10 Q. Yes.

11 A. I am quite sure that the pathway has  
12 been addressed in some way, whether it has been  
13 addressed as an explicit separate pathway or in some  
14 way through the pathway through vegetation or grass  
15 eaten by foraging animals, I am not entirely sure.

16 Q. I took the significance of the  
17 article was that Dr. Zach was going beyond radioactive  
18 uptake from soil through vegetation to animals, to the  
19 direct path from soil to animals?

20 A. Yes, that's what he was emphasizing.  
21 He was particularly emphasizing the applicability of  
22 this pathway for the assessment of waste management  
23 facilities, and as I say, that particular application  
24 has been implemented.

25 Q. Was there any reason for his

1       emphasizing that particular application?

2                   A. Well, I would have to read the  
3       article, more carefully, but one obvious reason that  
4       occurs to me is that with the waste management facility  
5       employing some form of burial, whether it's shallow or  
6       mid depth or deep burial as in the case of used fuel  
7       disposal, one can postulate scenarios involving the  
8       movement of radionuclides from below up through the  
9       soil, which would be somewhat different from the  
10      situation with a reactor operation where the soil  
11      contamination such as it occurs would be due to  
12      deposition of airborne emissions.

13                  Q. But that could take place too?

14                  A. That could take place as well.

15                  Q. The reason I was asking is because  
16      looking at your Exhibit 507 on pages 4-8 and 4-9, on  
17      page 4-9 there is a figure 4-1, entitled: Atmospheric  
18      Pathways, and it doesn't show the direct connection  
19      from air contamination to soil, to animal uptake in the  
20      third column of boxes over.

21                  Now, on page 4-8, about three or four  
22      lines up from the bottom of the page it refers to, this  
23      is a simplified representation of the atmospheric  
24      pathways, and that is why I was wondering whether it  
25      had just been left out in the specification, or whether



1 it isn't included, but I gather from your statements  
2 that you are not sure that it is included.

3 [3:28 p.m.]

4 A. I'm not sure. I certainly would  
5 agree this is a simplification. And really to look at  
6 the details of the environmental model used for derived  
7 emission limit calculation, you should look at the  
8 document which we provided in the interrogatory process  
9 that describes that.

10 Off the top of my head I don't recall  
11 that number, but there were two or three documents, I  
12 guess, provided in the interrogatories. One was the  
13 original document by authored by Dr. Wong. Then the  
14 CSA standard in 288.1 document, which described the  
15 model to use for calculating derived emission limits  
16 for normal operation; that was issued in the mid-80s.  
17 And there was about that same time, perhaps slightly  
18 after that, an update of the Ontario Hydro document  
19 authored by Dr. Gorman.

20 And that really, the latter document I  
21 referred to is really the definitive document used by  
22 Ontario Hydro for assessing or calculating derived  
23 emission limits.

24 Now quite or somewhat apart from that, I  
25 am talking about a model used for conservative



1 estimation of emission limits. There is the ongoing  
2 assessment of radiological environmental monitoring  
3 data performed by the health and safety division, which  
4 does include the consideration of measurements, actual  
5 measurements in the environment, of radionuclides. And  
6 in that way there is a check, if you will, on the  
7 adequacy of the model used in deriving the emission  
8 limits in the first place.

9 So no one is ignoring this pathway. It  
10 is a question of the discrete consideration of it as  
11 opposed to perhaps a more general consideration of it  
12 in the case of reactor assessment.

13 MRS. MACKESY: Mr. Chairman, I think I  
14 should be finished in five or ten minutes. Shall I  
15 continue?

16 THE CHAIRMAN: I think that might be best  
17 and then we can break at that time.

18 MRS. MACKESY: Thank you.

19 Q. My next set of questions has to do  
20 with the earthquake studies; and for that, I'm going to  
21 want to go to Exhibit 532.

22 Would I be right in my impression of  
23 reading that, that the studies which have been  
24 authorized by the Atomic Energy Control Board for the  
25 study of earthquake activity around nuclear plants is

1 limited to Darlington and Pickering?

2 MR. KING: A. With respect to this AECB  
3 research effort in Exhibit 532, that's my  
4 understanding, yes.

5 Q. Why would Bruce not be included in  
6 that?

7 A. I believe this study is looking at  
8 local anomalies in that area, given that those  
9 anomalies were in fact shown to be there, and then one  
10 postulated some seismic event at some location there,  
11 there would still be a potential impact on Bruce  
12 because earthquakes at far distances are felt at other  
13 locations. But I think that would have to wait until  
14 they showed through their studies that those anomalies  
15 in fact were there. It's that part of the Ontario  
16 geography that they are looking at.

17 Q. Has the area around Bruce been  
18 studied well for other types of anomalies?

19 A. It has certainly been studied. The  
20 whole country is broken down into seismic regions by  
21 the Geological Survey of Canada. Bruce is one of the  
22 lowest regions in all of Canada. But exactly what  
23 anomalies or what features they examined, I can't go  
24 into detail myself on those, but....

25 Q. I notice that the report by Mr.

1 Wallach on which these follow-up studies are based, I  
2 believe was entitled: Newly Discovered Geological  
3 Features and their Potential Impact on Darlington and  
4 Pickering. Is there a possibility that newly  
5 discovered features could turn up later around the  
6 Bruce area?

7 A. Well, it's hypothetical. I have no  
8 idea.

9 Q. Okay. And I have one last question  
10 now and that relates to the environment around Bruce,  
11 the aquatic environment. And yesterday it was brought  
12 to my attention that -- I was told that one of the  
13 reactors at Bruce had to be shut down because the smelt  
14 run had blocked the water intake. Is this something  
15 which happens, does anybody know whether this  
16 happens....

17 MR. JOHANSEN: A. It has happened  
18 before. I can't give you statistics as to frequency  
19 and so on, but I am aware that at this time of year  
20 when the smelt are running that they can plug the  
21 intakes, yes.

22 Q. What happens to the fish in that  
23 situation?

24 A. They are removed and disposed of.

25 MRS. MACKESY: Those are my questions,

1 Mr. Chairman. Thank you.

2 THE CHAIRMAN: Thank you, Mrs. Mackesy.

3 We will adjourn then for 15 minutes and  
4 then go on to the next cross-examination.

5 THE REGISTRAR: The hearing will recess  
6 for 15 minutes.

7 ---Recess at sets at 3:36 p.m.

8 ---On resuming at 3:52 p.m.

9 THE REGISTRAR: Please come to order.  
10 This hearing is now in session. Please be seated.

11 THE CHAIRMAN: Ms. deQuehen.

12 MRS. deQUEHEN: Good afternoon. My name  
13 is Ella deQuehen and I am representing Northumberland  
14 Environmental Protection.

15 I would like to enter the following  
16 exhibits, please.

17 THE CHAIRMAN: All right.

18 MRS. deQUEHEN: This volume of excerpts  
19 from research papers and studies.

20 THE REGISTRAR: This will be No. 670.

21 ---EXHIBIT NO. 670: Excerpts from research papers and  
22 studies in support of Northumberland  
Environmental Protection.

23 MS. HARVIE: Are there additional copies  
24 available for the witnesses?

25 THE CHAIRMAN: Has the panel not seen

1 this.

2 MS. HARVIE: No, Mr. Chairman, they  
3 haven't seen it.

4 THE CHAIRMAN: It's customary to let them  
5 see it first.

6 Are you going to use this as a basis for  
7 your questions?

8 MRS. deQUEHEN: I am using it really  
9 to -- as a basis, yes, for some of my questions.

10 THE CHAIRMAN: You are going to ask them  
11 questions about material that is in here?

12 MRS. deQUEHEN: I am really using it as  
13 an illustrative base to illustrate what I'm saying.

14 THE CHAIRMAN: Well, this is the time  
15 when you cross-examine the panel. When you bring your  
16 case in, that's a different time.

17 All you are here to do today is to ask  
18 this panel questions and you can use material of this  
19 nature to help you ask them questions. But really what  
20 you are doing is you are asking questions. You are not  
21 putting forward your case right now. That's something  
22 you do later. And this is not a time to argue your  
23 case either, if I can make that comment.

24 MRS. deQUEHEN: The second exhibit I  
25 would like to put in is excerpts from a publication

1 called "Radiation Induced Cancer from Low Dose Exposure  
2 and Independent Analysis" by John W. Gofman.

3 THE REGISTRAR: No. 671.

4 ---EXHIBIT NO. 671: Radiation Induced Cancer from Low  
5 Dose Exposure and Independent Analysis,  
by John W. Gofman.

6 MS. HARVIE: I'm sorry to interrupt. But  
7 if my understanding is correct, you are going to put  
8 these exhibits to the witnesses in which case they  
9 should be given copies as well.

10 MRS. deQUEHEN: Yes.

11 I made seven copies and as I explained, I  
12 am really only questioning Dr. Whillans and Mr.  
13 Johansen. I made one, two, three, four, five, six,  
14 seven, eight.

15 MS. HARVIE: That should do us.

16 THE CHAIRMAN: Do you have copies of  
17 these exhibits?

18 DR. JOHANSEN: Not yet.

19 ---Off the record discussion.

20 THE CHAIRMAN: Please take two of them  
21 and give them to Dr. Whillans and Mr. Johansen.

22 DR. WHILLANS: As we are sitting  
23 adjacent, we can probably share one.

24 MRS. deQUEHEN: The third exhibit I would  
25 like to put in is excerpts from the CFFTP project.



1 THE CHAIRMAN: That will be....

2 THE REGISTRAR: No. 672.

3 ---EXHIBIT NO. 672: Excerpts from Canadian Fusion  
4 Fuels Technology Project.

5 CROSS-EXAMINATION BY MRS. deQUEHEN:

6 Q. Dr. Whillans, you seem to have put  
7 across the impression that you believe that emissions  
8 from the normal operation of CANDU reactors pose a  
9 negligible health hazard to the people in the vicinity  
10 of the plant. Do you hold this view?

11 DR. WHILLANS: A. If would you  
12 substitute acceptable for negligible, then I would  
13 agree.

14 Q. And if you are substituting  
15 acceptable for negligible, you can express this view  
16 with certainty.

17 A. Well, it is my view.

18 Q. You stated that dose to the most  
19 exposed member of the public would be in the order of  
20 .05 millisieverts. Sorry, can you hear?

21 A. Yes, that's correct.

22 Q. What margin of uncertainty do you  
23 attach to that figure?

24 A. We haven't attached a number and so I  
25 am only giving you my view. First, I should say that I

1 believe the dose is more likely to be less than more  
2 and it's certainly within an order of magnitude.

3 Q. That means 10 times either way?

4 A. Yes.

5 Q. So it is possible that it could be  
6 0.5. It is within .5 to .005?

7 A. As I say, this is not based on an  
8 analysis. I am giving you my instant estimate of an  
9 outer range and of course I could be wrong as well.

10 The reason I say that it is more likely  
11 to be less than more is that we do two types of  
12 analysis: one based on emissions, and that's the  
13 number you are quoting; we also do an analysis based on  
14 environmental sampling and that tends to give lower  
15 numbers. In the 1991 annual summary and assessment of  
16 environmental radiological data which hasn't been made  
17 an exhibit, it was just issued last week, both types of  
18 analysis were done and that confirms what I say.

19 THE CHAIRMAN: Sorry, what was the  
20 document you said was issued last week?

21 DR. WHILLANS: We have filed or given in  
22 response to interrogatories a number of editions of a  
23 series which is called the Annual Summary and  
24 Assessment of Environmental Radiological Data.

25 And in the direct evidence I referred to

1 the 1990 data which was the latest available at the  
2 time. As I say, in the 1991 version which just became  
3 available last week, we have done both types of  
4 analysis. And what I have said about over-estimating  
5 is confirmed in that data.

6 MRS. deQUEHEN: But it is possible --

7 THE CHAIRMAN: Just a moment.

8 Perhaps that document ought to be filed.

9 MS. HARVIE: Yes, we will.

10 MRS. deQUEHEN: Q. It is possible it  
11 could be as high as you said as 0.5? Possible?

12 DR. WHILLANS: A. I think if we are  
13 going to use that number of .5, we should look at how I  
14 arrived at that. Yes, most of the dose to the critical  
15 group is derived from Noble gas emissions and they are  
16 monitored only by environmental monitoring TLDs. And  
17 so we have a good estimate of the exposures from that  
18 source, especially in the immediate area of the station  
19 boundary, where the doses would be highest.

20 Of the remainder, most is due to tritium  
21 and we have detailed environmental sampling of water  
22 and air, especially in the area nearest the boundary  
23 where the doses would be highest. And so I believe  
24 that those contributions are known quite well,  
25 certainly much better than within a factor of 10. And

1 then there are few other smaller contributors.

2 So I think that as a guess my estimate is  
3 probably rather generous.

4 Q. Yes, I was just really asking for  
5 margin of uncertainty but that's been asked, so thank  
6 you.

7 When you spoke of the DEL emission  
8 levels, you mentioned that they had been normalized for  
9 toxicity when you were being cross-questioned by Mr.  
10 Mattson.

11 A. Could you tell me how I said that, in  
12 what context --

13 Q. The DEL emission levels had been  
14 normalized for toxicity.

15 A. Could you tell me the context of that  
16 statement.

17 Q. Well, it is in the volume because  
18 that phrase comes out of it.

19 A. I'm not questioning whether or not I  
20 said it. I just wondered if you could tell me in what  
21 context I said it because I am sure what you mean.

22 MS. HARVIE: If you give us the volume  
23 number, we can find the context.

24 MRS. deQUEHEN: Q. Well, I will withdraw  
25 it because I honestly haven't got the volume number

1 written down. I didn't realize you would question it.

2 I am merely saying that levels can be  
3 normalized for toxicity. In other words, they were  
4 derived by taking the toxic or radiological event into  
5 account.

6 DR. WHILLANS: A. Well, I'm still not  
7 clear in what context it was said. I was thinking  
8 before you said that we may have been talking about  
9 tritiated water and T(2), for example, both of which  
10 contain the element tritium but one is much more toxic  
11 because it's readily absorbed into the body and T(2) is  
12 not.

13 Q. You were comparing both tritium and  
14 tritium oxide--

15 A. Oh, so that is the --

16 Q. --and saying that -- yes, within that  
17 comparison, they had been normalized for toxicity.

18 [4:05 p.m.]

19 A. Well, they are normalized to the  
20 extent that they are all based on a dose, a maximum  
21 dose to a member of the public. So if a radioactive  
22 element is not absorbed, it gives very little internal  
23 dose. So there are differences between different  
24 forms, and that's what I was saying.

25 Q. When you speak of dose to the public,

1       that too is derived by converting radioactive emissions  
2       into sieverts; is it not?

3               A. Yes, through a number of  
4       environmental transport pathways and then through  
5       uptake into the population. If it's the case of an  
6       internal contaminate, a dose is calculated based on a  
7       certain emissions from the station and that emission is  
8       limited by assuming a maximum permissible dose to any  
9       member of the public.

10              Q. Yes. What I am trying to get at it,  
11       it is the radiological dose that is judged to be  
12       hazardous or negligible or acceptable, not the  
13       emission, radioactive emission value.

14              I am not asking how they are derived, I  
15       know how they are derived, but I just want you to  
16       affirm that it is actually the radiological dose that  
17       is important, not the emission.

18              A. Well, under the current licensing  
19       situation that is the case. But we have talked with  
20       one of the other intervenors about the possibility that  
21       the regulator may change the basis for emitting  
22       emissions and then it might be different.

23              Q. You mentioned that the dose  
24       conversion factor for tritium and tritium oxide differ  
25       by some 10,000 times?



1                   A. Ten or 20,000, depending on which  
2 modelling you use, yes.

3                   Q. So a tremendous amount depends on  
4 these dose conversion factors, does it not? You can  
5 start with a higher emission and end up with a  
6 comparative low radiological dose, alternatively you  
7 can start with a comparatively low emission and end up  
8 with a hazardous dose, and it all depends on the dose  
9 conversion factors, does it not?

10                  A. If by the dose conversion factors you  
11 mean also --

12                  Q. I mean all the factors, yes.

13                  A. Those that account for uptake in the  
14 body, transport through the atmosphere, yes, those are  
15 very important.

16                  Q. So the level of radiological hazard  
17 hinges on these dose conversion factors, does it not?

18                  A. Yes, they are certainly important  
19 factors.

20                  Q. When Mr. Campbell was  
21 cross-examining, you went through the importance of  
22 derivation from high values to low values, and all the  
23 uncertainty, et cetera, and how it is necessary to  
24 extrapolate, and you agreed that within that process  
25 there could be an uncertainty of a factor of 3, was

1       that so?

2                   A. Well, again, I guess I would ask you  
3       to refer to me where that particular number came up in  
4       the examination.

5                   Q. Do you not remember that you said --  
6       spoke about a factor of 3 uncertainty?

7                   A. In one particular pathway or in  
8       general?

9                   Q. With regard to the dose response  
10      modelling.

11                  A. Oh, I'm sorry. I thought we were  
12      talking about environmental pathways.

13                  Q. No.

14                  A. With respect to dose response  
15      modelling, I was talking a factor of 3 as the present  
16      estimate of uncertainty in the risk per unit dose  
17      derived from the Japanese survivor data and other data  
18      as analyzed by groups such as UNSCEAR and BEIR, not a  
19      dose -- well, not what I would call a dose factor  
20      particularly. But specifically that the risk of fatal  
21      cancer, for example, per unit dose.

22                  Q. Are you aware that many of the  
23      researchers, the people involved in research in the  
24      field, many of whom are long standing members of those  
25      committees and agencies, are now stating, more or less,

1 it is not possible to extrapolate from high dose  
2 effects to low dose effects with any accuracy. There  
3 can be no reliability before biological mechanisms are  
4 better understood.

5 A. I doubt if there are many people who  
6 have said exactly that. But I accept that there is a  
7 range of views.

8 I think what I have presented is the  
9 consensus view I would seen say held by the great  
10 majority of people working in this field. But I accept  
11 that there are others such as your Dr. Gofman who have  
12 different views.

13 Q. Well, I will in a minute be  
14 presenting some evidence of views from people other  
15 than Dr. Gofman. I just wondered whether you were  
16 aware of it.

17 Would you say it is typical of industry  
18 regulators to admit uncertainty with regard to models  
19 and derivation assessments that proclaim doses and  
20 risks to the public with great assurance?

21 A. Well, I think you are asking a  
22 question about how information is presented to a  
23 usually non-scientific community. And I would agree  
24 with you that typically scientists do tend to give a  
25 single number because that is something that's more

1 easily understood than a range of numbers or a number  
2 with an uncertainty. So, to that extent, I guess I  
3 agree that this sometimes happens. Certainly in the  
4 popular press, for example, you very rarely see the  
5 uncertainty attached to a single number.

6 Q. You wouldn't say it is because  
7 regulators believe that the uncertainty, as it were, is  
8 buried, or would you say this is merely an example of  
9 discoursing at two levels, where you reassure the  
10 public and inform the agencies?

11 A. Well, I think the number with its  
12 attendant uncertainty is often widely enough known that  
13 it wouldn't be a question of burying information.  
14 Almost any information that's available, for example,  
15 to the AECB is public knowledge.

16 I think it would be more the case that in  
17 trying to present the meaning of a study for example,  
18 such as the leukaemia study we talked about many times,  
19 single numbers are often given because they are most  
20 easily understood. But I don't think it's a question  
21 of burying the other information.

22 Q. If you could please turn to the first  
23 reference in the green folder.

24 A. I have it.

25 Q. I think, Dr. Whillans, this may

1 illustrate what I was trying to ask you.

2 The first sheet is the piece of  
3 information that was sent to the public where at the  
4 very last phrase at the bottom it says:

5 Three hundred lives can be saved each  
6 year in Ontario through organized  
7 screening for breast cancer.

8 A. Yes, I see that.

9 Q. Now, if you turn to the third leaf,  
10 the black box at the top and the phrase just above it  
11 says:

12 On May 8th, 1989, the Minister of  
13 Health announced they would fund a breast  
14 screening program for the Province of  
15 Ontario. The organized program of breast  
16 cancer screening in Ontario when fully  
17 implemented will save more than 300 lives  
18 each year by recruiting at least 70 per  
19 cent... et cetera.

20 If you turn to the next page, at the  
21 bottom it says Evaluation:

22 The success or failure of the program  
23 will become evident five to seven years  
24 after it's fully implemented by  
25 determining whether there has been a

1 reduction in the number of deaths from  
2 breast cancer.

3 So when speaking to the public they say  
4 it can happen, when speaking to the Minister, who  
5 obviously they want to impress they say it will happen,  
6 but if you turn to the last page it is really -- the  
7 fact is, they haven't truly evaluated the situation  
8 yet.

9 A. Well, I think it is a bit dangerous  
10 just to take four or five isolated pages and draw firm  
11 conclusions.

12 Q. I said illustrative.

13 A. Yes, I agree, and I understand the  
14 point that you are making that people do give different  
15 information to different audiences. The information  
16 isn't necessarily conflicting but sometimes through its  
17 incompleteness it doesn't tell the whole story and you  
18 have to look at the whole purpose of that fact sheet on  
19 page 1, for example.

20 If there is evidence that this program  
21 can save lives and that is your objective, it is clear  
22 that it's important to recruit people into the program,  
23 and if you make it very complicated you are not going  
24 to do that.

25 I do agree, there is different



1 information on each of those page that you referred me  
2 to, but I don't think we have to necessarily look for  
3 anything sinister in it.

4 Q. Dr. Whillans, how much does the  
5 tritium removal facility cost, or perhaps someone else  
6 could answer that?

7 A. Does anyone have the exact number?

8 MR. PENN: A. I am not sure I have the  
9 exact number but I believe it was \$108-million, about  
10 that.

11 Q. About that, sure.

12 Now, the tritium removal facility is only  
13 postulated to reduce tritium emission rates by two or  
14 three times except at Darlington where it operates and  
15 hence, it will not reduce them?

16 DR. WHILLANS: A. Well, it depends on  
17 the way in which it's operated. If tritium is reduced  
18 to very low levels, then it could be a greater number,  
19 but it might be uneconomic to do that.

20 Q. Yes, but in your literature, which I  
21 will deal with later, it is postulated from two  
22 different sources in your literature, it is postulated  
23 only, that it will only reduce it by two or three  
24 times.

25 A. That's quite a substantial reduction,

1 actually.

2 Q. Yes. But the regulatory impact on  
3 dose and therefore on emissions could be reduced by a  
4 factor of 10 without even costing anything if the  
5 appropriate dose conversion factors, or the product of  
6 the dose conversion factors were lowered by a factor of  
7 10?

8 A. Are you saying the real dose to a  
9 member of the public or the estimated dose?

10 Q. I am saying the perceived dose. I am  
11 saying that if you reduce your dose conversion factors  
12 through a series of operations by 10, it doesn't cost  
13 the industry tuppence, and when you think you have  
14 spent all that money on a tritium removal facility  
15 which was only going to reduce it two or three times, I  
16 am merely saying, pointing out that it you can see how  
17 easily a conflict of interest could arise and I am sure  
18 you can see the objection which is frequently voiced by  
19 the public about industry managing its own dose  
20 assessment and dose risk assessment, risk assessment  
21 and dose assessment.

22 A. We could equally claim that we don't  
23 emit any tritium and as quickly probably be shown to be  
24 wrong.

25 I think the point is that there are

1 independent agencies that also monitor tritium, for  
2 example, in the environment, and they will be able to  
3 establish whether or not emissions have gone down by  
4 that factor. Health and Welfare Canada, for example,  
5 monitors tritium and other agencies as well.

6 Q. Yes, but I wasn't talking about the  
7 monitoring of tritium radioactivity. I was talking  
8 about the dose conversion process.

9 A. Well, that's part of it, though.  
10 Part of that transport process --

11 Q. I am not here talking about the  
12 actual level of emissions. I am merely talking about  
13 the conversion from emission to radiological dose.

14 A. Yes. Well, there is a number of  
15 elements --

16 Q. I am aware of them. I am --

17 THE CHAIRMAN: Let him answer the  
18 question.

19 DR. WHILLANS: And some of those elements  
20 which have to do with the dispersion of tritium once it  
21 left the stack, and environmental pathways all take  
22 place before the environmental monitoring which it is  
23 done independently by Health and Welfare Canada and  
24 other groups takes place.

25 If we know the level of tritium in the

1 water and in the air, many of those elements in the  
2 chain have already been passed, and it is really only a  
3 question then of the amount of that water that is taken  
4 in by the public, and then the dose that results from  
5 it.

6 So there are relatively few things that  
7 we could change and change the dose, given that we know  
8 and independent groups know what the levels of tritium  
9 are in the environment.

10 MRS. deQUEHEN: Q. But in the long run,  
11 Dr. Whillans, it depends what that conversion factor  
12 is. I am going to go to go into the levels of  
13 radioactivity, but whatever those are, it depends on  
14 what your dose conversion factor is?

15 DR. WHILLANS: A. When you use the word  
16 "dose conversion factor" are you suggesting the factor  
17 which relates -- the amount of dose delivered to the  
18 body per unit intake of, say, tritium from the  
19 environment? Because those numbers are not uncertain  
20 at all. They are just physical calculations of the  
21 energy emitted in a tritium beta ray and where it's  
22 distributed. There is not a great deal of uncertainty  
23 for tritium particularly in that calculation, and it  
24 certainly wouldn't be possible to pretend it was 10  
25 times lower.

1 Q. So when you spoke of an order of 10  
2 you were referring to pathways, not to the dose  
3 conversion factor?

4 A. Primarily, yes.

5 Q. Because I haven't even mentioned  
6 pathways yet. I am speaking about the dose conversion  
7 factor.

8 A. I did ask you at the beginning what  
9 you meant, I think, about dose conversion factors and I  
10 thought we had agreed that it was the whole -- of the  
11 chain of elements which took an emission from the plant  
12 through some sort of environmental transport pathway,  
13 through a dietary habit which takes it into the body  
14 and then gives dose. Now, it's those things which I  
15 would allow for a factor of 10 in. Certainly not in  
16 the tritium dose conversion factor. That's known much  
17 more closely than that.

18 Q. I misunderstood you. I thought that  
19 that fact of 10 was -- that you were admitting to an  
20 uncertainty in the dose conversion factors.

21 A. Well, no we are talking --

22 Q. Could I ask you what degree of  
23 uncertainty you think may exist in the dose conversion  
24 factors from radioactive emissions to radiological  
25 dose?

1                   A. When you say emissions I just want to  
2 be clear, you mean once they are taken into the body?  
3 Is that what you mean by a dose conversion factor? The  
4 number which relates a unit of activity of tritium  
5 taken into the body to the dose that's received from  
6 that exposure, or do you mean all the other things that  
7 led to that uptake into the body?

8                   Q. I am merely asking about the  
9 conversion of radioactive dose, radioactive absorbed  
10 dose to radiological dose?

11                  A. Okay. Well, in that case it would  
12 depend on the nuclide. Some of our emissions are not  
13 internal contaminants at all, the Noble Gas emissions  
14 irradiate from the outside. Other likes tritium are  
15 taken into the body. I would say tritium, the dose  
16 factor as you define it, is known very well, certainly  
17 within 50 per cent.

18                  Other nuclides maybe known less well and  
19 the reason is primarily that it depends on how long  
20 they remain in the body, and individuals vary, for  
21 example, in how long they retain certain nuclides. So  
22 it would depend on the nuclide.

23                  Q. So you are saying that there is not  
24 very much uncertainty surrounded with the measurements  
25 of these dose conversion factors?



1 A. Not for tritium particularly, and  
2 that's our major internal contaminant.

3 Q. So it is not open to interpretation  
4 or choices?

5 A. For tritium, no. It certainly has  
6 changed from time to time as new evidence has arisen,  
7 but it's not open to very much arbitrary  
8 interpretation.

9 Q. It is true, is it not, Dr. Whillans,  
10 that radiological risks can either be derived from  
11 models as we have been speaking of, or they can be  
12 measured directly, which one endeavours to do in an  
13 epidemiological study to see if there are any effects  
14 in the field?

15 A. Well, those are two different ways of  
16 arriving at the risk, I agree, yes.

17 Q. Now, generally, experimental  
18 empirical evidence will take precedence over  
19 theoretical models?

20 A. I wouldn't say that was always true.  
21 If your empirical evidence is so uncertain that it is  
22 not very helpful, then you may need to combine that  
23 with some sort of mechanistic information. For  
24 example, if your epidemiological study shows you  
25 something that is completely contrary to what you think

1 is known about how some kind of a toxic agent works,  
2 then that would cause you concern. You would want to  
3 find some confirming way of judging which was right and  
4 which was wrong. So I don't think I was generally  
5 true, no.

6 Q. Is it not generally true that models  
7 require to be verified by experiment?

8 A. I guess that's fair, yes.

9 Q. And if an experiment gives a  
10 different result it wouldn't throw your model into  
11 doubt?

12 A. Yes, that would be the purpose of  
13 verifying it. So that in you didn't verify you would  
14 be doubtful, yes.

15 Q. Evidence from epidemiological studies  
16 showing reproducible effects -- let me put this another  
17 way.

18 Which would you say would take  
19 precedence, if these two methods give different  
20 results, evidence from epidemiological studies showing  
21 reproducible effects or estimated values of risk  
22 assessment from estimated dose, if they showed  
23 reproducible effects?

24 [4:25 p.m.]

25 A. Yes, I think you would also have to

1 ask about the quality of the epidemiological study. If  
2 it were an analytic study which controls for many of  
3 the confounders we have talked about earlier or  
4 particularly if it were an experimental study, then I  
5 would say that that would probably be more reliable.  
6 If your purpose was to estimate the effects on that  
7 species in humans, for example. But all  
8 epidemiological studies certainly aren't the same with  
9 respect to the quality of the information that they  
10 allow.

11 Q. When epidemiological studies are  
12 done, some authors not wishing, presumably not wishing  
13 to find effects, will often state these effects can't  
14 be real; they must be due to chance. Because to find  
15 effects at this level would be inconsistent with risk  
16 assessment which has been done by the ICRP. Have you  
17 ever come across that attitude?

18 A. Well, first, I think I would have to  
19 say that most experimenters or epidemiologists do not  
20 want to find no effect. It's a sure way to lose  
21 funding for your studies.

22 So, I think most people look very  
23 carefully at their information. And if you are  
24 suggesting that researchers would tend to not to want  
25 to publish something that ran contrary to a major

1 body's opinion such as ICRP, I doubt if there is much  
2 pressure that way.

3 Q. I think the point I was really trying  
4 to make was that they never doubt the risk assessment  
5 for some reason.

6 A. No, I don't think I can agree with  
7 that.

8 Q. Have you seen papers where they do  
9 doubt the risk assessment?

10 A. Where people --

11 Q. Dose assessment.

12 A. Where people have found results which  
13 seem to be contrary to, say, the interpretations that  
14 ICRP have made and have nevertheless gone ahead and  
15 published them, oh, certainly.

16 Q. And stated that this throws it into  
17 doubt, the ICRP analysis?

18 A. I am sure that has happened, yes.

19 You have given us an example of that --

20 Q. Yes. Why did they do it in the  
21 first place if they did not doubt the risk assessment.  
22 Do you think that in the first place people perhaps do  
23 doubt that risk assessment because if they didn't, why  
24 would they go out there and do those experiments.

25 A. There are many reasons why people do

1 studies.

2 Q. But those studies would be  
3 inconsistent with risk assessment because at those  
4 levels -- if you believe that dose assessment/risk  
5 assessment, at those levels you couldn't get effects.  
6 And yet they spends millions of dollars looking just in  
7 case, so there must be some doubt in their minds.

8 A. Well, I think the example that comes  
9 to mind is the Sellafield study. No one expected that  
10 there would be a relationship between exposure of a  
11 father and leukaemia in children. And yet the evidence  
12 of a cluster suggested something like that might have  
13 been the case, so when the study was done they looked  
14 into whether the parents had been exposed and many  
15 other things.

16 So I think there are a number of reasons  
17 why people ask certain questions and I don't think we  
18 can generalize.

19 Q. Yes. But I mean it does, if there is  
20 an inconsistency it throws both things into doubt, not  
21 just one.

22 A. Yes.

23 Q. Could we first turn to paper by  
24 Hatch. It is reference 2. I chose this because the  
25 study has already been referred to by Mr. Bullock.

1 Also because here we are looking at cancer incidence or  
2 death actually in this paper before and after an  
3 incident but at the same location. Otherwise their  
4 objections or suggestions raised that risk may be due  
5 to other agents, artifacts of the location, toxins,  
6 viruses, et cetera. Do you agree that there could be  
7 an advantage in looking at this type of study over  
8 effects in looking at a study at a particular location?

9 A. I'm sorry --

10 Q. What you are looking at here is the  
11 effects before and after an accidental emission.

12 A. Yes.

13 Q. So if effects are found it cannot be  
14 said that they are artifacts of the location.

15 A. Not of the location per se but there  
16 may be other reasons. There may have been a big change  
17 in the location before and after; population migrations  
18 for example. I am not saying this a contributing  
19 problem in this study. But I don't think again that  
20 you can generalize. It is a good way of controlling  
21 for many of the physical circumstances of a particular  
22 site, yes, I agree with that.

23 Q. Perhaps I could ask you to respond to  
24 the following generalization about epidemiological  
25 studies. The first is: At low levels, they are



1 associated with a great deal of uncertainty because of  
2 the noise versus signal syndrome and the radiological  
3 dose would have to be above natural background level to  
4 pick up effects?

5 A. Well, no, I don't think that's  
6 necessarily true. When you say low levels, I guess you  
7 probably mean --

8 Q. I am talking in relation to the  
9 natural background.

10 A. Yes. What is really important is the  
11 dose in relation to the uncontrolled variation in the  
12 natural background. If you knew the natural background  
13 to everyone was 3.000 millisieverts, then there would  
14 be no problem investigating variations which were much  
15 less than that about it. The problem is that for some  
16 people it may be 3; for others it may be 2 or it may be  
17 4. And if you don't control for that variation, you  
18 can't really hope to find the effects which occur  
19 within that sort of number.

20 Q. Well, I mean, it's not easy to  
21 control for that and for the burden and that is why in  
22 these sort of studies you have the syndrome of noise  
23 versus signal, is that not so, and it is difficult?

24 A. That might be a good way to say it,  
25 yes.

1 Q. The second point is geographical  
2 factors. If the radiological emission is source  
3 emitted, then geographical factors determine the  
4 results such as extent of area under study,  
5 distribution of population. A small scale or what  
6 could be called a community study, a small-scale study,  
7 10 kilometres radius, taking account of wind source,  
8 which is case controlled, has a chance of picking up  
9 effects.

10 A. Depending on the level of the  
11 emission, yes--

12 Q. But it has a better chance --

13 A. --it sounds like a reasonably good  
14 design.

15 Q. However, a large scale county  
16 population study which ignores wind contours and uses  
17 national controls rather than case controls will  
18 naturally dilute the effect and the dilution will be in  
19 proportion to such things as population distance from  
20 source.

21 A. That sounds fair.

22 Q. These latter studies are usually done  
23 to ensure that local effects are not discernible at  
24 county or national level?

25 A. I think the latter studies are

1 usually done because that's the level at which  
2 information is collected. We don't often have detailed  
3 information on a 10-kilometre radius basis for many  
4 kinds of health effects.

5 Q. Yes, but....

6 A. So studies can't often be done in  
7 that way. It would have to be as you say some sort of  
8 a case control with a special measurement of the  
9 exposures.

10 Q. But what it is doing is diluting from  
11 the point source and hence has less good chance of  
12 picking up the effect?

13 A. I think that's well recognized. I  
14 referred to a study by Jablon in the U.S. where they  
15 looked at cancer around nuclear installations and they  
16 did it on the basis of counties I believe and it  
17 acknowledged in the report that this is not the most  
18 sensitive way to do it, but when you want to look at  
19 63, I think it was, installations it's the only  
20 manageable way to do it as a first approach.

21 And you don't take any special comfort  
22 from the fact that you don't see an effect but if you  
23 had then you would know where to focus your efforts.

24 Q. Yes. But I think that Mr. Bullock,  
25 for example, did take a great comfort in that type of

1 study.

2 A. Well, I can't comment on his comfort.

3 Q. The third point, and I think this is  
4 an important point, there is a very subtle distinction  
5 between causality and associative effects.

6 A. Yes. I don't think it should be  
7 subtle but people often confuse it, yes.

8 Q. I feel that has led to some  
9 misunderstanding at this hearing and perhaps we could  
10 just clarify this point.

11 Causality is almost never referred to in  
12 biological research which instead usually talks about  
13 demonstrating effects. When cause is suggested --  
14 although cause is suggested when there is a correlation  
15 between agent and effect, it is not proven in a complex  
16 system because they can always been unknown variables.  
17 Would you say that's fair?

18 A. Well, you talk about biological  
19 research. And often in that situation you have an  
20 experimental study where you can choose to control many  
21 of the subjects. That's quite different from an  
22 epidemiological study.

23 Q. Absolutely. But even so, it is very  
24 rare that the word cause is used. It is usually just  
25 demonstrated effect. If you observe a correlation, it

1 will strongly suggest but it won't actually prove  
2 because there can always be variables in a complex that  
3 is unknown.

4 A. That's fair.

5 Q. In epidemiological studies, they  
6 always state other causes cannot be ruled out and that  
7 is true enough; is it not? Generally they will state,  
8 could be this but other causes can't be ruled out.  
9 That's true enough?

10 A. I think most studies do acknowledge  
11 that a single interpretation may not be the only one.

12 Q. Yes. But it does not mean, does it,  
13 that an associative effect has not been found and  
14 rarely in the circumstances an effect is all you would  
15 expect. I mean, you wouldn't expect in a single  
16 epidemiological study to prove cause. You would only  
17 be -- what you are looking for is effects and if you  
18 haven't proved cause doesn't mean that effects have not  
19 been found.

20 A. Well, I may agree with you. A single  
21 study has as its objective to demonstrate a  
22 relationship and it may attempt to interpret it in  
23 terms of other information from similar studies which  
24 suggest causes but I don't think a good scientific  
25 study would often claim to have found the explanation.

1 Q. If such similar effects are  
2 repeatedly found, then the evidence is gradually  
3 substantiated; is that not so?

4 A. That's the principle of consistency  
5 that I referred to.

6 Q. Another reason why causality is not  
7 claimed could be because of legal repercussions; is  
8 that fair?

9 A. I can't think of a situation which  
10 that has been the case but it may have happened. I  
11 can't imagine exactly what you are referring to?

12 Q. Well, I think what I am referring to  
13 is if a study was done saying this facility has caused  
14 cancer, there would be legal repercussions.

15 A. But not often on the authors of the  
16 study.

17 Q. No. But they may well be subpoenaed  
18 and called upon and become involved and their funding  
19 may be jeopardized.

20 A. Well, I think that's speculative.

21 Q. Perhaps we could turn to reference 3.  
22 And I am just dealing with this very briefly. This is  
23 a review on the effects of fetal X-ray exposure. In a  
24 review of BEIR 3 material.

25 Now if we could just turn to the second



1 leaf, 443:

2 "An association between prenatal  
3 exposure to diagnostic X-rays and an  
4 increased risk of developing malignancy  
5 during childhood has been definitely  
6 established, but there remains the  
7 question of whether and to what extent  
8 this represents a causal relationship."

9 So they have definitely established  
10 effects but they still don't claim a causal  
11 relationship.

12 If you could just turn to the very end of  
13 this paper where it says Summary, the last paragraph:

14 "On the basis of recent (unadjusted)  
15 data from the Oxford survey, the best  
16 estimates of the relative risk of cancer  
17 after in utero irradiation are 5.0 for  
18 first-trimester exposure and 1.47 for  
19 second- or third-trimester exposures."

20 [4:40 p.m.]

21 So even where the effects have been  
22 increased by a factor of five, or 500 per cent, they  
23 still are not claiming causality. And all I'm saying  
24 is -- or causal effect. All I am saying is that I  
25 think there is some misunderstanding by public

1 authorities when a paper claims that there is no  
2 linkage, it thinks -- it appears to be disclaiming that  
3 any effect was found, or any possibility of a  
4 relationship exists?

5 A. Well, I think you pointed out a good  
6 example here. I spoke about some of these risks in my  
7 direct evidence.

8 This is from the 1980 BEIR 3?

9 Q. Yes, that's right.

10 A. It's referring to some earlier  
11 information.

12 At any rate, this evidence is generally  
13 no longer believed. There is not believed to be to be  
14 a substantial difference in risk through gestation.

15 I guess what we see here is a situation  
16 where the initial evidence had some problems. This was  
17 a study relating the number of X-rays that a mother had  
18 during pregnancy to the probability of effects in the  
19 offspring, and there were not actual doses to those  
20 mothers, and besides, the mothers were having X-rays  
21 for a reason. So there were a number of problems in  
22 the interpretation.

23 Q. I think that is all discussed in the  
24 paper.

25 A. That's correct.

1 Q. And they have brought the risk down  
2 from 8 to 5, but their conclusion --

3 A. Now, I believe UNSCEAR and ICRP, for  
4 example, would say that it is prudent to assume that  
5 there is an increased risk during pregnancy but the  
6 risk is not higher, not measurably higher in the first  
7 trimester than any other time.

8 And one of the contrary, we talked about  
9 consistently, contrary pieces of evidence is that these  
10 kind of effects have not been seen in some populations.  
11 There have been many, many studies beyond the Oxford  
12 survey and there isn't absolute consistently.

13 Q. Are you talking about the Japanese  
14 bomb victims?

15 A. And other medical studies in the U.S.  
16 as well. Some have confirmed this, some have not. And  
17 there is always the question --

18 Q. Are you aware of Abraham's work?

19 A. Sorry?

20 Q. Abrahamson's work?

21 A. Abrahamson?

22 Q. He is one of the leading people in  
23 the field and he says that -- well, perhaps I will get  
24 to that later.

25 A. Is this Seymour Abrahamson?

1 Q. Yes.

2 A. He is a geneticist.

3 Q. Certainly.

4 A. I was thinking more of MacMahon from  
5 Harvard.

6 Anyway, I was just pointing out that this  
7 is one reason perhaps why people are unwilling to be  
8 absolute about evidence which still has room for some  
9 doubt.

10 Q. Well, I was really only talking about  
11 the doubt and I was talking about the fact that  
12 effects -- I was using this in an illustrative manner  
13 that effects had been found, but even if effects at  
14 this time to that level were accepted, they still could  
15 not claim a causal relationship.

16 If we could just turn back to the Three  
17 Mile Island paper, and if you could please turn to page  
18 405.

19 Q. Sorry, can you hear me if I don't  
20 speak into the microphone. I seem to be having some  
21 difficulty.

22 THE CHAIRMAN: I can hear.

23 MRS. deQUEHEN: Can you hear?

24 THE CHAIRMAN: I seem to be straining.

25 Q. If we look at the bottom horizontal

1 line where I have speckled it with yellow and green.

2 DR. WHILLANS: A. I'm sorry, mine is not  
3 yellow or green.

4 This is page 405?

5 Q. 405.

6 A. This is under the heading All Cancer.

7 Q. That's right. Are yours not  
8 speckled?

9 A. No. But they have numbers written  
10 beside them and the words before and after.

11 Your lines are mark before and after?

12 Q. Yes, before and after. I'm so sorry,  
13 I thought I had speckled them. I put my children to  
14 it, they failed me.

15 The before was all speckled yellow and  
16 after was green merely to illustrate it.

17 Now, these refer to standardized ratios.

18 I am just looking at the ratio, not at fractionated  
19 effects and not at the fractionated doses. Just taking  
20 an average of these ratios, the before comes to .75,  
21 after .93.

22 A. If you say so. I think you have  
23 written 9.8 on my copy.

24 Q. .75, .98.

25 A. Yes, okay.

1 Q. The difference between these ratios,  
2 between those two ratios will give percentage increase  
3 in deaths after the accident, which is 31 per cent  
4 higher.

5 A. I haven't checked your numbers.

6 Q. Sure.

7 A. I take your word for it.

8 Q. At the bottom it says 1.31 total  
9 deaths and I have counted up the total deaths, it says  
10 .31 the extra deaths after the accident, cancer deaths  
11 after the accident comes to 671. So after the accident  
12 the 2,831 cancer deaths, of 2,831 cancer deaths, 671  
13 were extra deaths assumedly due to the accident?

14 A. Are you not doing what you were  
15 concerned about earlier, you are not suggesting what  
16 the uncertainty in any of these numbers would be.

17 Are the extra deaths after necessarily  
18 greater than zero, or do you any information about  
19 that?

20 Q. Of course there is uncertainty  
21 implied, but I am merely saying this is the effect that  
22 is shown, and when we get to a later stage I will read  
23 out some things where they about statistics on smaller  
24 numbers not really being that effective. I am not  
25 saying that there is not uncertainty implied, but when



1 with those numbers it will be expected that there could  
2 be some correlation with what actually happened, which  
3 being uncertain we do not know exactly.

4 Now, if you will turn back to page 400,  
5 it gives a measure of the dose which they estimated,  
6 and it states that the average dose was 0.1  
7 millisieverts.

8 A. I see that.

9 Q. The implication is that that dose  
10 could have caused some 31 per cent increase in cancer.

11 A. But that wasn't the conclusion of the  
12 authors.

13 Q. No, I am not saying it was.

14 A. All right.

15 Q. I'm saying that is the implication of  
16 these numbers and I am looking at the numbers, not the  
17 conclusion of the author.

18 A. Yes.

19 Q. If you look at reference 2B, which is  
20 just some numbers.

21 A. Yes.

22 Q. The population was 160,000 over five  
23 years, the average dose was 0.1, that's the data. If  
24 you turn over the page, using ICRP 77 risk estimates,  
25 which is here in another paper if you want to check it,

1 four extra deaths per 10 to the 6th person year per 10  
2 millisieverts.

3 A. Yes, I see that.

4 Q. That comes to .032 extra deaths,  
5 that's their risk estimate.

6 A. I see that.

7 Q. Whereas, the evidence appears to have  
8 suggested that there is 671 deaths, so there is quite a  
9 different, is there not?

10 A. It's certainly a very different  
11 number, yes.

12 Q. Now, this 0.1 is only twice what you  
13 are stating as your worst case.

14 A. That's correct.

15 Q. How many extra deaths would you  
16 expect from -- for such a population would you expect  
17 from 0.1 millisieverts a year?

18 A. Well, one of the problems is that the  
19 number that I talked about, which is half of that 0.1,  
20 was the maximum dose and you are calculating here the  
21 average dose to a large population. The average dose  
22 to population around Pickering, for example, is much  
23 less than that. It's much less than .01 millisieverts.  
24 So we couldn't do the calculation just from the maximum  
25 dose.

1 But in the direct evidence I did give a  
2 number for the total population dose, and around Hydro  
3 facilities, and if you assume something about what the  
4 population is, you could calculate what the average  
5 dose was, and I did give the number which was .1 deaths  
6 per year.

7 Q. But it doesn't really matter if it's  
8 maximum or average, I am not really trying to pin you  
9 down on how many deaths appeared on Pickering. I am  
10 just saying from this dosage, from 0.1, what would you  
11 expect? Would you expect something in the region of  
12 670 or 0.32?

13 A. .032, given those two choices, yes.  
14 A very small number.

15 Q. So you are prepared to completely  
16 disregard the experimental evidence?

17 A. Well, we are looking here really at  
18 your interpretation, not the authors--

19 Q. Yes, that's fair.

20 A. --of one particular study. And I  
21 think as we discussed a few minutes ago, you have to  
22 look at this in the context of all the other studies,  
23 and that's what a group such as BEIR, UNSCEAR does, and  
24 they don't come to numbers as large as yours, and  
25 neither do these authors for that matter.

1 Q. Well, these authors don't know,  
2 because they are not looking for it, but I am saying  
3 that this interpretation could be made.

4 If we could just look at Ontario Hydro's  
5 figures. Now, you stated that four to five extra  
6 deaths per -- it is just below it. Is that per 100  
7 person years, is that right? You said 10 to the 2?

8 A. Well, for the public it's 5 times 10  
9 to the minus 2 per person sievert. So this looks  
10 like --

11 Q. So you don't do it in person years.  
12 Per sievert.

13 A. This looks like the correct number,  
14 yes. Per 100 person -- What is this term, PY?

15 Q. Person years.

16 A. Per year. Well then, we have a  
17 problem.

18 Q. You can't convert of person years to  
19 person sieverts.

20 A. Well, the number I was giving you was  
21 the number of deaths that would occur any time in the  
22 following remaining lifetime of the exposed population.  
23 This is a different way to look at it, and it's a  
24 practical way when you have a finite study that goes  
25 for say five years and you look at certain population

1 over that period. But it's not as good a way because  
2 it doesn't take into account things like the latency,  
3 after an exposure suppose you wouldn't expect to see  
4 any cancers of a second kind and --

5 Q. But by and large it is still the same  
6 factors. I mean, whether you say 100 person years per  
7 sievert or is 100 persons per sievert year?

8 A. Well, as I say it's real a different  
9 basis of calculating and it doesn't take into account  
10 some of these other factors. For example, this study  
11 was done within 10 years of TMI, I believe.

12 Q. Well, they may not take into account  
13 all the factors, but using your risk estimate it comes  
14 to 4 as opposed to .03?

15 A. Well, I haven't checked your numbers,  
16 so I really can't agree or not.

17 Q. Well, it is just --

18 A. You say the population is 160,000.

19 Q. Yes. Five years.

20 A. And they received an average of .1  
21 millisieverts?

22 Q. Yes.

23 A. So I make that...

24 Q. Forty-five deaths?

25 A. Sixteen person sieverts.

1                   And using the number that I gave in  
2       direct evidence, that would result in about 0.8 cancer  
3       fatalities any time during the remaining lifetime of  
4       that population.

5                   Q.   0.8?

6                   A.   This is just to give you an order of  
7       comparison.

8                   Q.   Exactly, that's all I am looking for.

9                   A.   I should check those numbers if we  
10      want to be careful about it. But it's certainly a  
11      number less than 670.

12                  Q.   So your method gives some 20 times  
13      higher?

14                  [4:57 p.m.]

15                  A.   It looks more like a thousand times  
16      lower.

17                  Q.   No, but than the ICRP --

18                  A.   No, we are using the same number as  
19      ICRP. So as I say, I think the comparison of that  
20      number with 40 - is that a four? - is a difference in  
21      the methodology. I am saying this is the number of  
22      fatal cancers that may be induced in that whole  
23      population anytime during their remaining lifetime, and  
24      you are considering a five-year period, so we would  
25      have to--



1 Q. I am only considering a five-year  
2 period.

3 A. --do something else to look at that.

4 Q. Yes. But I mean you could adapt  
5 yours to a finite period.

6 A. You could do.

7 Q. Well, it's still exceedingly low  
8 compared to what?

9 A. Compared to 670, that's right. It is  
10 low.

11 Q. I will just say that with regard to  
12 the 670, I will point out that these deaths could have  
13 been under-estimated due to the fact that -- and this  
14 was pointed out by a number of critics because of  
15 migration of people from the area after the accident.  
16 Also, I will point out that I am only measuring from 81  
17 to 85 in these figures. 80 is left out. If you  
18 calculate what 80 would have been, it could have been  
19 as high as a thousand deaths, so it could have been 670  
20 to a thousand, but I am just using 670 because I  
21 haven't checked with the authors exactly about  
22 everything in the report.

23 DR. CONNELL: May I ask where the figure  
24 of 2,831 total deaths came from? Is that given  
25 somewhere in the text?

1 MRS. deQUEHEN: Yes. In these two  
2 horizontal yellow and green, I am looking at the deaths  
3 after the accident. In the brackets is the deaths of  
4 each category, the total if that is the number --

5 DR. CONNELL: You simply added up those  
6 numbers?

7 MRS. deQUEHEN: That's all, yes. It's  
8 just the number of deaths that occurred and what  
9 percentage. 671 may not seem enormous but it would  
10 translate to something like 7,000 people in Toronto  
11 dying. That is not negligible.

12 DR. CONNELL: And then you simply took 31  
13 per cent of that number, did you?

14 MRS. deQUEHEN: Sure. That's all.

15 DR. CONNELL: You weren't concerned about  
16 the confidence intervals that are given in that table?

17 MRS. deQUEHEN: No. I am merely taking  
18 it as a guideline of what sort of order of deaths were  
19 perceived, whether it is the same order as is found by  
20 ICRP risk assessment and it's some thousand times  
21 higher.

22 Q. Dr. Whillans, do you think it is  
23 possible that their dose estimate here, this 0.1, could  
24 have been largely, very largely, under-estimated?

25 DR. WHILLANS: A. Well, I don't really

1 have any direct experience but everything I have read  
2 suggests that the releases from TMI were very small.  
3 So I think that the dose, the average doses would have  
4 been of that order. I don't think they are seriously  
5 under-estimated.

6 Q. So you don't think there is a  
7 possibility?

8 A. Well, as I say, my reasons for saying  
9 this are not any more than just what I've read, but I  
10 don't think so.

11 Q. You don't think there is a  
12 possibility that those deaths could have occurred as a  
13 result of that dosage?

14 A. No, I don't think so.

15 Q. Well, there is a great discrepancy.

16 A. Yes.

17 Q. How would you account for that then?

18 A. Without really going through your  
19 calculations, I can't be sure how you arrived at the  
20 numbers. All I can say is that if such a number were  
21 true, it would be at great variance with many other  
22 studies, and the kinds of studies that are summarized  
23 in documents like UNSCEAR or BEIR 5, who provide the  
24 risk numbers that I was using when I was giving you an  
25 estimate.

1                   So there would have to be, thinking  
2   hypothetically, there would have to be something very  
3   different about that situation not related to radiation  
4   exposure or the kinds of things that you are  
5   attributing the deaths to. But as I say, without  
6   checking the numbers I really can't comment on whether  
7   those are correct or not.

8                   Q. Well, I mean as Dr. Connell pointed  
9   out, what I was doing was fairly straightforward, just  
10   seeing how many extra deaths occurred in that period if  
11   the ratio had suddenly become 30 per cent higher. I  
12   mean it's just....

13                  A. Well, I'm just quoting from the  
14   conclusions of the author that the pattern -- this is  
15   from the abstract:

16                   The pattern results does not provide  
17   convincing evidence that radiation  
18   releases from The Three Mile Island  
19   nuclear facility influenced cancer risk  
20   during the limited period of follow-up.

21                  Q. I think that was going to be the next  
22   question I asked you. Even--

23                  A. Sorry.

24                  Q. --in the face of these extra deaths,  
25   they still draw the conclusion that there is no causal

1 relationship.

2 A. Well, Dr. Hatch is a qualified  
3 epidemiologist with a good reputation. She works at a  
4 university, not for the owners of the facility.

5 Q. Well, I'm not quarreling with the  
6 fact I think that they are not drawing a causal  
7 relationship. I am just saying that even in the face  
8 of effects, the face of extra deaths, they do not  
9 quarrel with the result that there are extra deaths.  
10 They merely say that it can't be related to radiation  
11 because the radiation was low.

12 Do you know what they put the cause of  
13 death down to?

14 A. No, I'm sorry, I don't.

15 Q. Well, they actually don't do it in  
16 this paper but in the next they state it must have been  
17 due to stress; in other words, that people died of  
18 fright because of the accident. Do you think that that  
19 is plausible?

20 A. As you state it, no, I don't think  
21 that's plausible, not 670 people.

22 Q. The paper that was also presented by  
23 Mr. Hammer, Hamner....

24 A. Hamer, yes.

25 Q. Hamer. Also put effects from

1 Chernobyl down to stress. Does it not appear that  
2 industry is casting about for excuses in its need to  
3 protect its position on negligibly low dose risk  
4 assessment which it has adopted?

5 A. No, I can't agree with that.

6 Q. Should there be an admission that the  
7 deaths might be due to radiological effect, it would  
8 throw the risk assessment/dose assessment into  
9 confusion, suggesting that they could be seriously  
10 under-estimated. I mean, if you accepted those deaths,  
11 then you would have to accept that the risk assessment  
12 and dose assessment particularly is seriously  
13 under-estimated.

14 A. Well, certainly these numbers would  
15 not be consistent with those risk assessments, yes.

16 Q. I was going to say just one final  
17 observation even in the face of this, but we have had  
18 that question.

19 If you can turn to the next paper.  
20 Reference 4, and it's really just these first few  
21 papers I am doing in any detail. After that I am just  
22 flying through. A paper by Bernard Shleien.

23 A. I don't know Dr. Shleien. I don't  
24 know how he pronounces his name.

25 Q. I don't either.



1           The author reviews 40 epidemiological  
2 studies around nuclear facilities including the  
3 Canadian studies. If we could just start halfway down  
4 the abstract:

5                   "Epidemiological studies yielded  
6 results that were biologically plausible  
7 and were supported by experimental data,  
8 but in almost all of the studies the  
9 methodologies were not adequate for  
10 evaluating causality."

11           So here again, is it not true, you get  
12 effects but not adequate for evaluating causality?

13 [5:07 p.m.]

14           It goes on to says:

15                   In the majority of cases the  
16 methodologies did not permit examination  
17 of dose response associations making it  
18 impossible to support or refute causal  
19 relations. We suggest that investigators  
20 consider these issues when designing  
21 studies and employ dose reconstruction  
22 methodology to estimate the radiation  
23 doses for specific individuals and  
24 population groups.

25           So here he is questioning or he is

1 asserting that they should look closely at dose.

2 A. Yes.

3 Q. If you go to the right-hand column, I  
4 don't know if it was marked, it's supposed to have a  
5 yellow line down it. Right-hand column, the middle  
6 paragraph:

7 In this paper we summarize published  
8 epidemiologic studies around the nuclear  
9 facilities and discuss them in light of  
10 established, albeit sometimes  
11 controversial postulous for establishing  
12 causal relations between exposure and  
13 disease. In particular we discuss why  
14 studies around nuclear facilities often  
15 indicate that an increased incidence of  
16 mortality exists but thus far have failed  
17 to demonstrate convincing links between  
18 these increases in radiation exposure.  
19 That is the purpose of it.

20 A. I think we should mention here that  
21 one of the problems which he maybe running into is what  
22 is called publication bias. If a study is done and it  
23 finds no effect, often the study won't be published,  
24 whereas if it does find an effect, it's more easily  
25 published. So if you just surveyed the literature and

1 look at all the studies, you are likely to find a  
2 biased estimate of any particular effect.

3 Q. Well, I don't think that is really  
4 legitimate. You can as well raise funding bias. Most  
5 of these people are funded by other radiological  
6 industries and if they find effects they lose their  
7 funding.

8 A. I wasn't suggesting those were the  
9 only biases that come up in studies.

10 Q. Certainly. If we could move to page  
11 707, Discussion, just the first phrase there,  
12 Conformity with Hill's postulates and other criteria  
13 for epidemiologic analysis.

14 Now you have mentioned Hill's postulates  
15 in your direct evidence, did you not?

16 A. Yes.

17 Q. It's true to say there is a fair  
18 amount of criticism which he mentions too with regard  
19 to Hill's postulates, criticism that it fractionates  
20 the results such that it weakens the statistics, many  
21 of those postulates have not been completely verified  
22 and such criticisms?

23 A. I think really all they are, are  
24 principles which indicate the strength with which you  
25 can make a causal conclusion from a given set of data

1 and some things cannot be satisfied in a certain kind  
2 of study and that weakens it.

3 I think it is fair that these principles  
4 are fairly widely used by epidemiologists, but there is  
5 controversy about them, sure

6 Q. Certainly. Page 708 halfway down it  
7 says Analogy.

8 Analogy is one of the least useful of  
9 Hill's postulates. All of the studies  
10 reviewed in this paper are analogous  
11 studies of radiation carcinogenesis, et  
12 cetera, et cetera.

13 Then if you go down to where it says:

14 To health physicists the most  
15 important among Hill's postulates is the  
16 requirement for a dose response  
17 relationship. In the majority of studies  
18 we reviewed, the absence of tests for  
19 dose response relationship precluded  
20 establishing cause and effect  
21 relationships. Use of geopolitical  
22 boundaries and distance as surrogates for  
23 radiation dose is not an adequate  
24 substitute for determination of dose.

25 Fair enough?

1 A. Yes.

2 Q. So he says the postulate that rarely  
3 matters is the dose.

4 A. Yes, because we mentioned this in one  
5 of the studies of occupational exposures that has just  
6 been published in the U.K., when you can look at  
7 different dose categories within the same population,  
8 then you can correct for biases such as the healthy  
9 worker effect or other biases which apply to the whole  
10 population. So the dose response is a very important  
11 thin where you can demonstrate it, but often--

12 Q. Where you can demonstrate it.

13 A. --in observational study you can't do  
14 that.

15 Q. But it isn't only. He is saying that  
16 that is an advantage, to have a dose response.

17 A. It would be, yes.

18 Q. But he is also saying that you must  
19 actually have a dose reconstruction and be sure of the  
20 dose you are doing these studies at.

21 A. Yes.

22 Q. He then points out, which is  
23 well-known, that if this dose is the below the  
24 background level, it will be swamped and --

25 A. That's generally true.

1 Q. If we could just move to conclusion.

2 In the conclusion, the second paragraph done, it says:

3 The most serious problem we identified  
4 was the absence of quantitative estimates  
5 of radiation dose that could be used to  
6 assess dose response relationships --  
7 which we have stated. Most studies --  
8 If you could move to the next column

9 halfway down:

10 Besides raising questions about  
11 current risks for low doses, community  
12 studies also addressed the possibility  
13 that radiation exposure may have been  
14 underestimated by current measures.  
15 Epidemiological studies alone cannot  
16 assess both questions at the same time,  
17 however, a thorough quantitative analysis  
18 of all doses received by exposed persons  
19 can help to clarify through dose response  
20 analysis where the risk estimates or dose  
21 estimates may be in error.

22 Fair enough?

23 A. Yes.

24 Q. So he is actually saying there is  
25 something wrong here.



1           A. Well, I think he is saying in many  
2 studies this is a weakness, yes.

3           Q. And he has stated in this study that  
4 these effects occur, but these, the risks associated  
5 with effects do not add up with the doses as we know  
6 the risk estimate.

7           A. I think that's certainly fair in some  
8 studies, yes.

9           Q: Well, he is generalizing about all  
10 40.

11           Most of the questions that the  
12 reviewed epidemiologic analysis attempted  
13 to answer could have been answered more  
14 adequately with a corresponding  
15 independent radiation dose assessment.  
16 Furthermore, we suggest that there is  
17 little value in pursuing epidemiological  
18 analysis of radiation induced cancer  
19 without such estimates. Epidemiologic  
20 investigation needs to employ modern dose  
21 reconstruction methodology to estimate  
22 radiation dose with specific individuals  
23 and population group. For the public and  
24 the scientific community to believe those  
25 estimates, data must be compiled and

1                   assessed by independent scientists. And  
2                   all analysis should receive thorough  
3                   reviewed by scientific peers and the  
4                   general public.

5                   Would you agree that he is raising the  
6                   possibility, in fact the conclusion of this review is  
7                   that dose assessment could be seriously underestimated  
8                   and that this problem must be solved before any further  
9                   steps are taken?

10                  A. Well, I think he certainly has said  
11                  that in many studies dose estimates are not very good.  
12                  They are uncertain and he does talk about the  
13                  possibility that exposures may have been underestimated  
14                  by current methods, and whether that's true in all  
15                  cases I really can't say.

16                  Q. Would you not say that generally all  
17                  cases use the same dose assessment methodology, which  
18                  is the ICRP methodology?

19                  A. No, I don't think so. I am sure if  
20                  he has been studying 40 studies, he has looked at  
21                  studies over 20 years perhaps, and different  
22                  methodologies would certainly have been used. A  
23                  different methodology would be used around a power  
24                  station compared with some other kind of source, I  
25                  think. It could vary quite a lot.

1 Q. He is really only looking at nuclear  
2 facilities and power stations.

3 A. That's true. Testing sites.

4 Q. Testing sites. But they all use the  
5 same dose methodology.

6 A. Some of these studies I think  
7 actually measure activity in the population, for  
8 example, some of these tests. I haven't looked at this  
9 carefully for some time, but some of these test site  
10 studies actually measured activity taken up by people.  
11 So I think there would be a range of methods.

12 DR. CONNELL: Dr. Whillans, if his  
13 conclusion is indeed that there may be a prevailing  
14 tendency to underestimate exposures, would it follow  
15 also that there would have been a tendency to  
16 overestimate the risks?

17 DR. WHILLANS: That would follow, I  
18 think, yes.

19 MRS. deQUEHEN: Q. Do you mean in this  
20 particular study there would be an overestimate?

21 DR. WHILLANS: A. I think Dr. Connell is  
22 saying that if you have a certain number of effects and  
23 you attribute it to a certain dose, if the dose were  
24 actually higher, then the risk per unit dose would be  
25 less than what you think it is.

1 He is saying that the doses seem to have  
2 been underestimated which means the risks have been  
3 overestimated, because there is an inverse  
4 relationship. It's the number of health effects  
5 divided by the dose that caused it.

6 Q. Well, they are derived independently.

7 A. Those two factors?

8 Q. Dose assessment and risk assessment  
9 are derived independently. That is why he says one or  
10 other is wrong.

11 As for the studies in general, the usual  
12 pattern emerges, local case control show effects  
13 whereas the large scale population ones don't show  
14 effects, which you have already agreed is probably the  
15 case.

16 Are you aware of the next reference,  
17 reference 5, a study by Dr. Clapp and others?

18 A. No, I haven't seen it before.

19 Q. Well, Dr. Clapp informed me that  
20 Ontario Hydro wrote to him, after I had phoned him they  
21 wrote the next week and asked for the study, so I  
22 thought you might have seen it.

23 A. I haven't seen it, I'm sorry.

24 Q. Well again, this shows effects  
25 particularly and some specific. It's looking at

1 leukaemia, and downwind from the facility it showed  
2 effects. This was then repeated for the county and no  
3 effects were found. So it just illustrates the point.

4 A. Well, I can't comment whether the  
5 local effect was real or not, but I agree with you that  
6 that principle would be true, it would tend to dilute  
7 the effect.

8 THE CHAIRMAN: I wonder if we could stop  
9 now. Are you finished with reference 5?

10 MRS. deQUEHEN: Yes

11 THE CHAIRMAN: You are finished with  
12 that, reference 5. I wonder if we could have stop  
13 until tomorrow.

14 Would it be possible to start at 9:30 in  
15 the morning, would that be all right?

16 MRS. deQUEHEN: Certainly.

17 THE CHAIRMAN: We will start at 9:30 in  
18 the morning and we will adjourn now.

19 THE REGISTRAR: This hearing will adjourn  
20 until 9:30 tomorrow morning.

21 ---Whereupon the hearing was adjourned at 5:20 p.m., to  
22 be reconvened on Tuesday, May 12, 1992, at  
23 9:30 a.m.

24  
25 JAS/KM [c. copyright 1985]











